

# RAILROAD GAZETTE

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## EDITORIAL ANNOUNCEMENTS.

**THE BRITISH AND EASTERN CONTINENTS** edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

**CONTRIBUTIONS.**—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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## CONTENTS

### EDITORIAL:

|  |     |
|--|-----|
| Interstate Rate Making by the States....               | 527 |
| An Interesting Government Report on Block Signals..... | 527 |
| The Work of the Interstate Commerce Commission.....    | 527 |
| Passenger Results Under Two-Cent Fares.....            | 527 |
| The Erie Saved from Receivership.....                  | 528 |
| The New Pennsylvania Rail Sections.....                | 528 |
| The Flat-Spot Limit on Car Wheels.....                 | 529 |
| New Publications.....                                  | 529 |

### ILLUSTRATED:

|  |     |
|--|-----|
| How the States Make Interstate Rates..             | 530 |
| Reinforced Concrete Trestle on the Burlington..... | 538 |

|  |     |
|--|-----|
| The Pennsylvania New Rail Sections and Specifications..... | 539 |
| New Rails for the Canadian Pacific.....                    | 543 |
| The Last of a Famous Class.....                            | 548 |
| Kansas City Terminals of the Missouri, Kansas & Texas..... | 550 |

### MISCELLANEOUS:

|   |     |
|---|-----|
| An Italian Unit of Locomotive Performance.....                            | 530 |
| The Ocean Carrier.....  | 540 |
| Block Signals on the Railroads of the United States, January 1, 1908..... | 543 |
| China's Plans for New Railroads.....                                      | 548 |
| Rail Committee of the Maintenance of Way Association.....                 | 548 |

|  |     |
|--|-----|
| Foreign Railroad Notes:                          |     |
| Death of a Railroad Man of 1839....              | 549 |
| Difficulties of Railroad Building in Africa..... |     |
| A Federal Railroad Law in Argentina              |     |

### GENERAL NEWS SECTION:

|   |     |
|---|-----|
| Notes.....                                  | 551 |
| Interstate Commerce Commission Rulings..... | 555 |
| Trade Catalogues.....                       | 556 |
| Meetings and Announcements.....             | 557 |
| Elections and Appointments.....             | 558 |
| Locomotive Building.....                    | 558 |
| Car Building.....                           | 558 |
| Railroad Structures.....                    | 558 |
| Railroad Construction.....                  | 559 |
| Railroad Corporation News.....              | 560 |

VOL. XLIV., No. 16.

FRIDAY, APRIL 17, 1908.

The presence of "strong" state railroad commissions all over the country, active in making rates, and making them always on a distance basis, is so new a thing that we have as yet scarcely had opportunity to study the actual workings of the system. The paper by Robert Mather, which we print in full this week, takes up the interstate effect of state rates with admirable clearness, and the accompanying rate charts show the far-reaching effect of ignorant local tinkering with rates. It is entirely idle to assume any longer that a state is so isolated that its own special brand of railroad regulation has no effect on its neighbors. State rate-making has tremendous power to change traffic currents and to build up or break down one set of ports or distributing centers at the expense of another set. But the competition between states is always at the expense of the railroads. Rates are always changed down, and this process brings its own limit when confiscation is reached. Even the most casual examination of Mr. Mather's analysis shows what a chaos our national system of railroad regulation is in. The states have created a tangle of authority and of jurisdiction that it will require years of patient work by the courts to straighten out.

The information given in the Interstate Commerce Commission's report of block signal mileage, just issued, is so condensed and so varied as to defy both the editor and his blue pencil, and we print the tables in full. The roads which largely increased their signal equipment in 1907 are literally too numerous to mention, though the Union Pacific system and the Southern Pacific Company, reporting a total of 3,750 miles of road equipped with automatic block signals, almost three times as much as in the report of the preceding year, cannot escape being prominent. The second, third and fourth tables give highly interesting details never before published. The fourth, telling of imperfect practice, seems to be an imperfect table, for there are items which appear to indicate that the signaling on certain roads is much more thorough and complete than it really is. This is due, no doubt, to careless use of signaling terms by the railroad officers reporting, a thing which has made difficult the preparation of statistics on this subject in the *Railroad Gazette* office. To readers not familiar with the practices of some of the single-track western lines the last column of Table 4 should be explained as meaning stations where trains are allowed to disregard the stop signal to the extent of running past it far enough to make a convenient station stop. While this practice is unscientific, it is a money-saver; and

by the enforcement of proper speed-limit rules and meeting-point regulations it has been managed with success. The extent to which controlled manual apparatus is used without track-circuit locks is one of the significant things shown by Table 3, though here again we suspect that there are errors, making the total too large. The other salient fact in this table is that there are now a dozen roads on which the Morse telegraph is no longer supreme in manual block signaling, telephones or electric bells being used.

An examination of the cases in our column of "Interstate Commerce Commission Rulings" this week will show any one who is not already aware of the fact that the Commission by no means always favors the shippers in its decisions, and also that it is not, as some of its critics declared in advance that it would be, making every effort to extend its powers to the uttermost. There are, to be sure, in the list decisions lowering classification, reducing rates and awarding reparation, as well as condemning the practice of inserting obscure and general clauses affecting rates in voluminous tariff publications. But, on the other hand, the Commission upholds a competitive rate adjustment between Trunk Line and Central Freight Association territory, in an important decision upholding the principle that the effect of competitive conditions must be taken into account in fixing rates and must often be held superior to the long and short haul clause. In three of the decisions the Commission definitely limits its authority. It declares that it has no authority over steamship lines to Cuba or to require roads to establish special passenger fares based on less than the normal rates, or any authority whatever over routes and shipments in Indian Territory and Oklahoma Territory before their incorporation as the state of Oklahoma. The work of the Commission under its extended powers is one gratifying result of the agitation for greater control of railroads. It is generally admitted by railroad men and by shippers that the Commission is attempting with all the fairness and ability at its command to work with even-handed justice as between shippers and carriers.

The annual report for the year ended December 31, 1907, of the Grand Rapids & Indiana, just issued, makes the following statements in regard to its passenger earnings for the year:

The total number of passengers carried was 2,340,475, an increase of 12,878, or 0.55 per cent. The average rate per passenger

per mile was 2.08 cents, an increase of 0.02 cents. Reduction in passenger fares became effective in Indiana on April 10, 1907, and in Michigan on September 28, 1907. During the first nine months of the year, when the maximum legal intra-state rate on the Grand Rapids & Indiana, in the state of Michigan, was 2½ cents a mile, passenger earnings increased \$77,189, or 8.39 per cent.; the number of passengers decreased 59,887, or 3.97 per cent.; the passenger mileage increased 3,017,737, or 6.90 per cent., and the passenger train mileage increased 3,759, or 0.42 per cent. In the three months ended December 31, during which the maximum legal intra-state was 2 cents per mile, the passenger earnings decreased \$16,449, or 5.29 per cent.; the number of passengers increased 50,118, or 15.11 per cent.; passenger mileage decreased 387,033, or 2.51 per cent., and the passenger train mileage decreased 2,101, or 0.79 per cent. For the entire year there was an increase in passenger train miles of 1,658. It cannot, therefore, be maintained that the Grand Rapids & Indiana has suffered a decrease in its passenger earnings because of any diminution of service, and the results from passenger traffic as shown above do not bear out the prediction of the advocates of the 2-cent fare that the lower rate would be supplemented by such an addition to the travel as to compensate for the difference in charge.

### THE ERIE SAVED FROM RECEIVERSHIP.

The Erie Railroad, owing to its financial history and to the nature of its geographical location, has perhaps to work harder for a living than any other American railroad system at all comparable in mileage or importance. It has a through line from New York to Chicago, with branches to Cleveland, Buffalo and Rochester, but the handicap of the capital charge placed upon it by former generations has kept it from perfecting its physical requirements to enable it really to meet on even terms the severe competition of its neighbors, particularly of the New York Central and Pennsylvania systems. In round figures the Erie is capitalized at \$186,000 a mile and earns \$23,800 a mile; the Pennsylvania Railroad is capitalized at \$152,268 per mile and earns \$42,719 a mile from operation, in addition to which there are very important earnings derived from interest on investments, and the New York Central is capitalized at \$114,807 a mile and earns \$26,010 from operation. In the case both of the New York Central and of the Pennsylvania important "other income" not included in the above figures is only partially offset by rentals.

The relation between the earning power of the Erie and its annual burden of interest, as compared with that of its principal competitors, is clearly shown by these figures. The road went into the hands of receivers at the outset of the 1893 panic and emerged in 1895. Prior to that and since the opening of the line from Piermont, N. Y., to Goshen in 1841, it went into receivers' hands in 1841, 1859 and 1875. In the last few years, under the very able administration of President Underwood, its earnings have surprised even its admirers, increasing from 38 millions in 1899 to 51 millions in 1907 on substantially unchanged mileage, while generous appropriations have been made annually out of income for the physical betterment of the property. In the last five fiscal years \$8,847,733 have been added to the assets in this way without corresponding increases in the liabilities, while maintenance, both of way and structures and of equipment, has been above the strict necessities of upkeep; but, in spite of this good work, the line has been, and still is, far behind the physical standard necessary to enable competition to be met effectively, and it was necessary for the company to increase its capital pretty fast year by year and add new charges so that interest could be earned on old and new alike. It was estimated, doubtless very roughly, last year, that the requirements to put the property in really first-class shape were not far from \$25,000,000.

The surplus above preferred dividends for the 1907 fiscal year was equal to almost 3 per cent. on Erie common stock if this surplus be credited with the sum charged off for betterments; otherwise it was equal to about 1½ per cent. on the common stock. But at the same time that the road was making this good showing with its current earnings it was being very much embarrassed by the fact that some of its capital debt was maturing at a period when it was almost impossible to do any new financing. On April 8, 1907, \$3,000,000 of notes matured, and \$2,000,000 more had to be taken care of between April and July, 1907. The bond market at that time was in a deplorable condition, and it would have been manifestly impossible even for a strong road to finance long-term bonds on a basis that the directors would consider. The note market had also

been glutted, because nobody cared to pay 6 per cent. or more for permanent funds, and notes had been issued in such abundance and by so many strong and thoroughly solvent companies that the outlook for the notes of a financially top-heavy company was not good.

Therefore, the Erie adopted the very unusual expedient of issuing notes discounted in advance, after the manner of commercial paper, and by this device it obtained the necessary \$5,000,000, although at high cost. These notes fell due April 8, 1908, but no plan for taking care of them was announced until April 4. At that time the directors authorized a \$15,000,000 issue of new 6 per cent. three-year notes to take up the old notes and provide additional cash, and they announced that the sale and purchase of these notes at par had been underwritten without commission or cost to the company, but upon the express (and impossible) condition that all the \$5,500,000 notes of 1907 should be exchanged, par for par, for the new 6 per cent. notes within four days. The announcement laid great stress upon the requirements that all outstanding notes must be deposited before 3 o'clock on April 8, and as this gave the noteholders four days and a few hours in which to deposit their notes, European investors would have required a kind of rapid transit at present unknown, in order to fulfil the condition.

Consequently, when April 8, the day of the climax, arrived, only a small part of the notes had been deposited, and the Erie was perhaps as close to a receivership as any road avoiding one has ever been. It was not until late Wednesday afternoon that the public learned that E. H. Harriman had that day offered to purchase \$5,500,000 of the new 6 per cent. collateral trust gold notes at 95, provided the Erie would pay all the old notes at par by April 15, allowing holders of the 1907 notes the choice of cash or new 6 per cent. collateral trust notes at par, together with a cash bonus to the amount of 5 per cent. This dramatic offer was promptly accepted by the railroad company, and the notes rose so fast on the market that they squeezed the shorts and sold at two or three points above par.

The receivership having thus been averted by Mr. Harriman, the syndicate headed by J. P. Morgan & Co. forthwith announced that it would take \$5,000,000 of the new notes at par in accordance with its original plan, thus financing the company's requirements for the present. So far as can be humanly predicted, therefore, the Erie is safe from receivership this year, but what the future of the property is to be is a matter of the greatest interest. It may frankly be stated that the record of the last five years has been so good that the capitalization per mile does not look as high as it used to, and another long-continued period of prosperity with the same scrutinizing, careful management of the property might quite conceivably place it on a plane of earnings where it would be reasonably safe; but the physical disabilities have got to be overcome; money has got to be spent to overcome them, and it will be difficult to find any keen and eager purchasers for new Erie bond issues. The suggested "bloodless reorganization," by means of which it was proposed to change some of the interest-bearing debt into some other form of security, thus lessening the chance of insolvency and foreclosure in dull times, would doubtless furnish one kind of relief. Another kind of relief could be obtained if anybody could be found strong enough and rich enough to make the future of the road his personal interest, to finance its rehabilitation, and to give it traffic. Mr. Harriman is better able to do this, if he cares to, than anybody else in the country, and we have a strong impression that under vigorous Harriman methods a way could be found to make the Erie profitable. Whether or not his interest in it is anything more than temporary, assumed for the good of the general situation, is one of the interesting questions in railroad strategy which the near future is likely to determine.

### THE NEW PENNSYLVANIA RAIL SECTION.

We show this week two new rail sections, one adopted by the Canadian Pacific, the other by the Pennsylvania. The Pennsylvania has been making an exhaustive examination of the entire art and practice of rail making, taking it up almost as if it were a new subject, and in June, 1907, it appointed an able committee, consisting of the ten men whose names are given in another column. To make a practical test of the work of the committee the company placed an experimental order for 10,000 tons of rails in December, 1907, to be rolled in accordance with the new sections and specifications. The experience with these rails has resulted in some slight changes in the specifications, but no change has been made in the sections, and the Pennsylvania system has adopted as a standard for its 1908 orders the new sections and specifications as revised



February 4, 1908. It will be observed that the angle of the line under the head of the rail has been increased to give more draw to the splice and to allow better work on the head; that the radius at the ends of the top of the head has been made as large as possible to reduce the strain on the overhanging part of the head and to occasion less wheel wear at the bottom of the flange, and that the width of the base has been reduced and its thickness has been increased in order to balance the section and to counteract, so far as possible, the rapid cooling of the base as compared with the head, which requires the head to be finished too hot. In calculating the depth of the base the committee worked with the size of the head and the width of the base as constants, and with the total height of the rail as a variable. The following table shows a comparison of the principal dimensions of the 100-lb. rail as compared with the present standard of the Pennsylvania Railroad and with the A. S. C. E. section used on the Lines West:

|                                     | Penn. R. R.        |                   | Am. Soc. C. E.  |
|-------------------------------------|--------------------|-------------------|-----------------|
|                                     | New specification. | Present standard. | Lines West.     |
|                                     | (100 lb. rail).    | (100 lb. rail).   | (100 lb. rail). |
| Head, area, sq. in.                 | 4.09               | 4.48              | 4.15            |
| Web, area, sq. in.                  | 1.85               | 1.99              | 2.02            |
| Base, area, sq. in.                 | 4.03               | 3.49              | 3.65            |
| Actual weight                       |                    | 101.5             | 100.2           |
| Moment of inertia                   | 41.9               | 38.34             | 44.09           |
| Section modulus, head               | 13.71              | 13.40             | 14.60           |
| Section modulus, base               | 15.91              | 14.30             | 16.20           |
| Width of head                       | 2 1/2 in.          | 2 13/16 in.       | 2 1/2 in.       |
| Radius, top of head                 | 10 in.             | 10 in.            | 12 in.          |
| " top corners head                  | 7/16 in.           | 7/16 in.          | 5/16 in.        |
| " bottom head                       | 1/16 in.           | 2/16 in.          | 1/16 in.        |
| Angle, sides of head                | 15 degs.           | 13 degs.          | 13 degs.        |
| Angle, under sides, head            | 23/32 in.          | 23/32 in.         | 25/32 in.       |
| Splice bearing under head           | 1 3/32 in.         | 1 5/32 in.        | 1 1/2 in.       |
| Depth of head                       | 2 3/8 in.          | 2 1/4 in.         | 2 3/8 in.       |
| Depth of web                        | 9/16 in.           | 1/2 in.           | 9/16 in.        |
| Thickness of web, thinnest part     | 3/16 in.           | 1/4 in.           | 3/16 in.        |
| Fillet where web joins head & base  | 10 in.             | 8 in.             | 12 in.          |
| Radius of web                       | 13 degs.           | 13 degs.          | 13 degs.        |
| Angle at top of base                | 1 3/32 in.         | 1 1/2 in.         | 1 3/32 in.      |
| Depth of base at center line        | 1 1/16 in.         | 1 1/4 in.         | 1 3/32 in.      |
| Radius of fillets at corner of base | 5 3/8 in.          | 5 3/8 in.         | 5 3/8 in.       |
| Width of base bearing               | 5 in.              | 5 1/8 in.         | 5 3/8 in.       |
| Depth of base                       | 5 11/16 in.        | 5 1/8 in.         | 5 3/8 in.       |

In preparing the new specifications the point of view which the company took was that nobody knows just how great the discard ought to be, hence that it is better to specify that "there shall be sheared from the end of the bloom formed from the top of the ingot sufficient discard to insure sound rails," than to attempt to describe this discard in detail. It is noteworthy that a drop of 15 feet is prescribed for the drop test, and that the dimensions of the testing machine are carefully set forth. The specifications are printed entire on page 539 of this issue.

### THE FLAT-SPOT LIMIT ON CAR WHEELS.

The maximum allowable length of flat spots on car wheels was fixed at 2 1/2 in. by the Master Car Builders' Association in 1878, and has never been changed. Recommendations to reduce this limit have been made at various times but the association has always rejected them. Last summer G. W. Kittredge, Chief Engineer of the New York Central, addressed a letter to the president of the American Railway Engineering and Maintenance of Way Association, stating it to be his belief that the present allowance is too great; that the effect of a spot of the maximum allowable dimension under a 100,000-lb. car at high speed must be very bad, and in the interest of safety the rule should be modified. He suggested that the Maintenance of Way Association indicate this feeling to the M. C. B. Association. President Johnson agreed with Mr. Kittredge and thought the relative effect of flat spots under light and heavy cars should be determined. The matter was taken up with the Executive Committee of the M. C. B. Association, who referred it to the Arbitration Committee with instructions to confer with a committee from the Maintenance of Way Association. The president of the latter association designated as this committee the one on Iron and Steel Structures, and from this a sub-committee of three members was appointed to take charge of the matter. This committee, consisting of A. J. Himes, C. D. Purdon and A. D. Page, made a progress report at the recent convention of the Maintenance of Way Association.

At the time the 2 1/2 in. limit was set the largest freight cars carried 40,000 lbs. and weighed 22,000 lbs., giving a load of 7,750 lbs. per wheel. With present 100,000-lb. cars, which, with the permissible 10 per cent. overload will have a total gross weight around 150,000 lbs., the load per wheel will be about 18,750 lbs., or 2.4 times the load of 1878. While it is not easy to say what the increase in maximum speed of freight trains has been, the report assumes about 100 per cent. Two things must be known in order to determine the economic effect of reducing the M. C. B. limit: the probable increased expense, and the benefit to be received. The lack of rec-

ords has made it impossible to estimate the increase in number of wheel renewals a change would cause, and the other expense incident thereto. It was decided at a joint meeting of the two committees in December to gather during January and February statistics from which to make such an estimate, but the results were not available at the time the report was prepared.

To estimate the benefits to accrue from such a reduction of the flat-spot limit is probably impossible in figures. While it is known that a flat wheel delivers a pretty hard blow to the track at each revolution, the force of the blow and the damage done are hard to determine. On this point the report says: "It is easy to conceive of much possible damage to frogs and switches and to rails, and of occasional broken rails; and, likewise, of damage to rolling stock and delays to traffic and injuries to the surface of the track; but to collect statistics of specific cases of such damages, and conclusive evidence of the cause of the injury, is something that is very hard to accomplish. On many railroads numerous cases of broken rails are charged indefinitely to flat wheels, but, admitting the correctness of the charge, it generally appears that the wheels are those of a locomotive or tender carrying loads in excess of those on ordinary car wheels and having spots in excess of those specified by the M. C. B. rules. It is quite evident, however, that if a locomotive with 40,000 lbs. on an axle is the cause of broken rails, a heavily loaded gondola car, having about the same weight on the axles might just as readily produce the same effect."

The report contains a theoretical discussion of the force of the blow resulting from a flat spot, in which an expression for the impact is deduced. This impact is shown to be proportional to the square of the length of the flat spot, so that by reducing the latter one-half, the blow would be only one-fourth what it is at present. The reduction actually recommended to the M. C. B. Association is from 2 1/2 in. to 1 3/4 in., which would reduce the impact approximately one-half. As regards the relative strength of wheels, load per wheel, and increased impact from flat spots, it is stated that the first drop test specified for car wheels, which was in 1889, was a 140-lb. weight falling 12 ft., or 1,680 ft.-lbs. At present for 700-lb. wheels it is a 200-lb. weight falling 12 ft., or 2,400 ft.-lbs., an increase of about 43 per cent. But since the flat-spot limit was established the load per wheel has increased 240 per cent. and the impact from a flat spot therefore 960 per cent.

Prof. Benjamin, of Purdue University, has devised a plan for an apparatus to measure the effect of flat spots. He proposes using only one wheel, on which flat spots of different lengths can be made and the effect of the impact recorded. An ordinary pair of wheels mounted on an axle will be used, with one wheel running on a friction wheel and the other—the one to be tested—running on a rail curved to circular form in a horizontal plane. Beneath this rail will be a recording mechanism in the form of a suitable hammer, which will indent a strip of soft metal. These indentations will be calibrated by an impact machine and the exact magnitude of the blow thus determined. The machine could be run any length of time, with different applied weights, lengths of spots and speeds, and any number of records taken. This sort of apparatus could also be used for determining the effect of counterbalance blows. The committee recommended that the association take some action with regard to carrying out such a series of tests. The cost of installing the apparatus was estimated at \$1,500. The committee further suggested that the impact tests to determine the effect of moving loads on bridges include observations on the effects of flat spots. Tests such as are proposed to determine the force of impacts from flat spots might also be helpful in throwing light on the magnitude of service stresses in cast iron car wheels. These stresses are greatest, of course, when running through frogs and crossings, but there would seem to be no practical difficulty in producing these effects in the test apparatus.

### NEW PUBLICATIONS.

*Automatic Block Signals and Signal Circuits.* By Ralph Scott. New York: McGraw Publishing Co. 243 pages; 6 in. x 9 in. Price, cloth, \$2.50.

This is a copious collection of diagrams of electric circuits such as are used in automatic block signaling, including the complicated arrangements for electric locking by track circuit control at interlockings, with examples taken from many situations, few of which, however, are named. Circuits for controlled manual block signaling are also shown, together with an example of the Taylor electric interlocking. The author describes all these circuit combinations and gives some brief instructive comments; but his material appears to have been put together with little regard for any systematic plan, and many of his descriptions are useful only to readers already thor-

oughly versed in the subjects treated. "Railroad terms have been omitted," he says, "because they are meaningless to the average reader"; but the "average reader" would find less fault with railroad terms than he will at the absence of the elementary information that he needs on such a technical subject. The dozen pages on maintenance constitute perhaps the best chapter in the book; and maintenance is an important subject, for (we read) "when any serious trouble occurs, its results increase with great rapidity, owing to the momentous position which signals possess in a competent aggrandization."—(!)

#### An Italian Unit of Locomotive Performance.

BY LAWFORD H. FRY.

During the spring of last year the Italian Government Railroads introduced a unit previously employed on the Adriatic Railroad for use in the comparison of locomotive performances. For the purpose of instituting comparisons of fuel and water consumption between various classes of locomotives, and as a basis for the coal premiums of the enginemen, it was considered desirable to have a more logical unit of work done than is afforded by the "ton-mile." With this object in view, the idea of the "virtual kilometer" was introduced and the work done by the locomotives is now measured in "virtual ton-kilometers," which are found by multiplying the weight of the train in tons, not by the actual distance through which it is hauled, but by a virtual distance which brings into account the grades and curves over which the train is moved. This obviously gives a more logical measure of the work done than the actual ton-kilometrage does. The practice of measuring locomotive performance by the actual ton-mileage is widely extended, but in making any comparison of results on this basis, it must be borne in mind that the work done by a locomotive is dependent on the ton-mileage, on the class of service, and on the character of the road over which the ton-mileage is produced.

The American Railway Master Mechanics' Association decided in 1901 that while it is desirable to keep a record of locomotive performance on a ton-mileage basis, yet it is improper to make comparisons between the results on different railroads on this basis, or even between the results on different divisions of the same line; the only fair comparison on a ton-mileage basis being between locomotives on the same division of a railroad.

In calculating the virtual distances on the Italian railroads the mean train resistance on a straight and level track was assumed to be 4.5 kilog. per metric ton. This was, however, increased about 10 per cent. to 5.0 kilog. per ton in order to make an allowance for that part of the fuel which is consumed while running, but which is independent of the work done at the drawbar, as for example that which is required by the losses of heat by radiation from the boiler, by leakages and for the steam required by special appliances.

On this basis, on a falling gradient which is sufficient to keep the train in motion, the minimum virtual distance would be one-tenth of the actual distance, but to cover the coal burned while accelerating and stopping the train, the minimum virtual distance on any grade is taken as one-fifth of the actual distance, and as an allowance for starting, the minimum distance between any two successive stations is taken as one kilometer.

The train resistance on the level being taken as 5 kilog. per ton, or one-half of 1 per cent. of the train weight, it follows that the virtual distance, inclusive of the effect of curves, is the actual distance increased by one kilometer for each five meters of rise, or decreased by one kilometer for each five meters of fall between the points considered. In English measure this corresponds to a mile added or subtracted for each 24.4 ft. of difference of level.

The curves are taken into account by considering them as replaced by rising grades in accordance with the following table:

| Radius of curve. | Equiv. rising grade in per 1,000 ft. or resistance in kg. per metric ton. | Radius of curve. | Equiv. rising grade in per 1,000 ft. or resistance in kg. per metric ton. |
|------------------|---|------------------|---|
| 1,000 meters.... | 0.5   | 400 meters....   | 2.0   |
| 900 "....        | 0.6   | 350 "....        | 2.4   |
| 800 "....        | 0.8   | 300 "....        | 2.8   |
| 700 "....        | 1.0   | 250 "....        | 3.4   |
| 600 "....        | 1.2   | 200 "....        | 4.2   |
| 500 "....        | 1.5   | 180 "....        | 4.5   |
| 450 "....        | 1.7   |                  |   |

The foregoing is expressed in the formula—

$$L_v = L_a + \frac{h + \sum p l}{5}$$

where  $L_v$  is the virtual distance in kilometers,

$L_a$  is the actual distance in kilometers,

$h$  is the difference in level in meters, positive if the grade rises and negative if it falls,

$l$  is the length in kilometers of each curve,

$p$  is the grade corresponding to the curve in the table above.

In English measure this formula is

$$M_v = M_a + \frac{d}{26.4} + \frac{\sum p k}{26.400}$$

where  $M_v$  is the virtual distance in miles,

$M_a$  is the actual distance in miles,

$d$  is the difference in height in feet with the proper sign,

$k$  is the length of each curve in feet,

$p$  is the grade corresponding to the curve in the above table.

This formula is used to determine the virtual distances on rising grades and on falling grades less than 0.4 per cent., while on steeper descents the virtual distance is taken simply as one-fifth of the actual. For use on the Italian railroads a small book has been compiled showing the actual and virtual distances for all parts of the system. By means of this it is a simple matter to calculate the virtual ton-mileage of any train.

It may be of interest to analyze somewhat further this conception of the virtual distance, using for the purpose English measures. In the first place, to restate the definition. The virtual distance between two points is the distance through which a train must be drawn on a straight level track, with a train resistance of 11.2 lbs. per ton (0.5 per cent.) for the work done to be equal to that required to take the train over the actual distance with its grades and curves. Leaving for the moment the question of whether or no the figures chosen for the train resistance are correct, it is obvious that each virtual ton-mile represents a definite measured expenditure of work. To move one ton of train requires a force of 11.2 lbs., so that each virtual ton-mile requires the expenditure of  $11.2 \times 5,280 = 59,136$  ft.-lbs. of work. If the train speed were 10 miles an hour, the rate of working would be very nearly 0.3 h.p. for each ton of train weight.

In this lies the value of the virtual distance as a basis of comparison; the virtual ton-mileage is a measure of the mechanical work required for the train movement and is, therefore, a logically correct standard by which to measure the coal and water consumption, etc. The coal consumption per virtual ton-mile is in a sense a measure of the mechanical efficiency of the locomotive, but it does not measure the commercial efficiency of the railroad.

In other words, the virtual ton-mileage measures the work performed by the locomotive, but does not measure the amount of transportation effected, which is the commercial product of the railroad.

For the latter purpose the actual ton-mileage is the proper measure.

Now, as to the accuracy of the assumption that the mean train resistance on straight and level track is 11.2 lbs. per ton. It is obvious that, as in all the attempts to express the conditions of railroad operation by a simple formula, no very high degree of accuracy can be attained.

For average results the assumed train resistance appears to be well chosen. It must be borne in mind that the ordinary service on the Italian railroads does not involve any very high train speeds, so that it is not likely that the actual train resistance will exceed the assumed figure.

The mean resistance on the level has been put at the rather high figure of 11.2 lbs. per ton, with the object of making allowance for the various heat losses which are not dependent on the work being done by the locomotive. As no corresponding increase has been made in the resistance due to grade curves, the virtual distances as calculated have a tendency to give too little weight to the effect of grades. This is to some extent compensated for by the fact that usually the speed is reduced on the grades and the rolling resistance is thus somewhat lower than it is on the straight and level track.

There seems to be no doubt but that the use of the "virtual ton-kilometer" is a valuable step in the direction of recording locomotive performance on a logical basis.

#### How the States Make Interstate Rates.\*

BY ROBERT MATHER,  
President, Rock Island Company.

The widespread efforts of state legislatures and railroad commissions within the past two years to reduce railroad rates have presented many interesting phases to public observation. The extent and severity of the proposed reductions, the novel expedients adopted to prevent or to make difficult a review of the state action in the federal courts, the resulting conflict of judicial authority and the recent decision of the Supreme Court of the United States holding these expedients unconstitutional have kept the movement constantly in the public mind. Out of the many questions which discussion of the situation has evolved none are more interesting or important than those relating to the effect of state-made rates upon rates for interstate transportation. It is the purpose of this article to show that the rate-making power of the states should be diminished or destroyed, or that this object, if desirable, can or cannot be accomplished under the federal constitution, but merely

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†Much of the matter and all the maps for this article were prepared by Mr. Theodore Brent, of the Traffic Department, Rock Island-Frisco Lines, Chicago.



to state and to illustrate the proposition that, in fact, the states *do* make interstate rates.

The great movements of traffic in this country are eastward and westward. The volume of the westward movement has always been high-class merchandise—dry goods, wearing apparel, groceries, hardware and like articles. Formerly this was all produced in the East or imported through Atlantic ports; it is only within recent years that the larger cities in the West have become manufacturing centers.

When the evolution of our rate fabric began New York, Boston, Philadelphia and Baltimore were the bases of supply. Chicago, St.

between the Mississippi river and Chicago on the one hand and the Missouri river on the other were fixed not at what would be a reasonable rate for the distance, but at what it was necessary to maintain in order that St. Louis and the lines leading through St. Louis might compete with Chicago for the expanding business of Kansas City, Atchison, St. Joseph and Omaha.

In the territory west of the Missouri river the same process has been repeated, and rates are maintained in such relation not only that Kansas City, St. Joseph and Omaha may compete with each other, but that goods distributed from St. Louis and Chicago, as well as from the eastern cities, may be handled through Kansas City, St. Joseph or Omaha and laid down at the several consuming points at practically the same freight cost. In the Northwest this same competitive adjustment is maintained between Chicago, Duluth, Minneapolis and St. Paul. In the Southwest, Chicago, St. Louis and Kansas City must be kept on an even keel, and when Texas is reached the whole adjustment is modified to meet the competition of coastwise steamers plying from New York to Galveston. To Colorado and Utah the routes through all these gateways are kept in constant adjustment, and the rates so arranged that Denver and Pueblo are enabled to do a distributing business.

What is true of westbound merchandise is equally true of the



Fig. 1.

Louis, St. Paul, Omaha and Kansas City owe their development as trade centers primarily to strategic location at the head of navigation, or at points where the transcontinental trails left the water-courses for the West, Northwest and Southwest. They commenced as outfitting points for prospectors and settlers; their business was that of distributing through the new western country the articles of commerce manufactured in or imported through the East, and that still constitutes a large part of their trade.

When railroads found their way to Chicago and St. Louis their rates were fixed largely by the water competition which met them on



Fig. 2.

their arrival. Gradually railroads were constructed westward from these points and, as they reached common territory, the force of competition began to be felt. Intense rivalry developed between the distributing houses of Chicago and St. Louis, and pressure was brought to bear upon the railroads, both East and West, to keep the rate fabric so adjusted that goods, stored in and distributed from either city, might be laid down at any of the Missouri river points at substantially the same freight cost. The class rates from New York to Chicago thus became the basis of measurement for all class rates. The St. Louis rate was a fixed per cent. higher, approximating the difference in the cost of reaching that point by water. The rates



Fig. 3.

movement to the East of the great staples raised in the West. The grain territory is so divided and rates are so made that grain may move freely to the Mississippi river, the lakes and the gulf, through the great storage centers of Minneapolis, Duluth, Chicago, St. Louis, Omaha and Kansas City. In like manner live stock rates are so arranged that the traffic may move freely to the rival packing centers of Kansas City, St. Joseph, Omaha, St. Paul, Chicago and St. Louis.

These rate relations are not the work of the traffic departments of the railroads. They do not exist by virtue of acts of legislatures or of orders of commissions. They are the resultants of the commercial growth of the country. Trade is established along these lines; industries and communities are founded on the basis of these adjustments, and their existence and prosperity depend upon the continuance of these rate relations. They are the controlling facts in all rate disputes—more stubborn than distance and as immovable as mountains.

There is hardly a rate on any article of commerce but feels the force of these competitive conditions. They absolutely dictate the traffic policy of the railroads operating in the territory affected by them. The carrier makes no rates that are not effectively moulded by these conditions, and the rate-making power of the Interstate Commerce Commission itself cannot ignore them. The only rate-regulating body that makes rates without reference to these com-

mercantile conditions is the legislature or the railroad commission of a single state. Its field of operations includes but a fraction of the territory whose traffic is controlled by these conditions; contains but few of the larger distributing centers which compete for that traffic, and is usually circumscribed, either wholly or in part, by imaginary boundaries fixed without regard to factors which exercise controlling influence upon the trend of traffic and of rates. The influence of lakes, of rivers and canals, the competition of rival markets, the relation between manufacturer and dealer, and other like forces that, in the making of rates, confront the traffic officer of an interstate railroad and the Interstate Commerce Commission itself, enter but slightly, if at all, into the calculations of the state. In every case, in the exercise of its rate-making power, distance is the one factor given serious consideration, and the result of its labors is invariably the production of a distance tariff.

This state distance tariff is, on its face, a simple and a harmless thing. The right of the state to make it and to change it at its will seems to be amply buttressed by the conceded principle of law that the power of Congress over interstate commerce leaves untouched the power of the states to regulate their purely internal commerce. And no simpler or less obnoxious method of exercising that power would seem possible than to describe the rates at which traffic shall move from point to point within the state.

But when the traffic officer of an interstate railroad comes to apply this state distance tariff, made for state use on purely local considerations, to the traffic that actually moves over his rails, he finds that he cannot confine its influence to traffic within the state, and that, against his will and without his action it readjusts his rates into and out of and through the state, and determines his revenues on traffic that never traverses the borders of the state. This is illustrated by the action of the following states:

#### MISSOURI AND IOWA.

Missouri has a far-reaching control over interstate rates by reason of the situation of the state at the point of least distance between the Mississippi river—the basing line for rates from the East—and the Missouri river, the base line for rates to the West.

There are three factors which go to make up the rates from the East to the western territory—whether or not they are published as through rates—namely, the rate from the seaboard to the Mississippi river or Chicago; the rate from the latter base line to the Missouri river, and the rate west of the Missouri river. Reduce the rate between the Mississippi river and the Missouri river and you reduce the rates on all business either locally or through or beyond these base lines.

The first-class rate between the Mississippi and Missouri rivers practically determines the interstate rates on all classified articles moving between the East and West. It is at present 60 cents per 100 lbs., this being the figure fixed by the Missouri Railroad & Warehouse Commission as a reasonable maximum rate for the short-line haul of approximately 200 miles across the state from the Mississippi to the Missouri river—the distance from Hannibal to St. Joseph being 196 miles—and from Hannibal to Kansas City 199 miles. Note the chart:

Though this rate is based on the distance of 200 miles, competitive conditions outside the state apply it at once to all hauls across the state, no matter what their distance. The short line from St. Louis to St. Joseph is 302 miles, and lines operating between these cities would be privileged, under the commission's maximum scale, to charge 74 cents, first class. The short line between St. Louis and Kansas City is 277 miles, for which distance the commission's scale is 71 cents, first class. But here considerations enter which are entirely outside the horizon of the Missouri commission. The rates from New York to Hannibal and St. Louis are the same. There are routes leading from New York to St. Joseph and Kansas City, through both Hannibal and St. Louis, Kansas City and St. Joseph, compete in the same territory, and the rates to both points from

New York must be kept the same through all gateways. Consequently the commission's maximum rate for the shortest distance becomes the rate between all four crossings.

Thus the element of distance even between points within the state is immediately modified by outside forces, controlling with the carriers, but which exerted no influence upon the commission when it fixed the nominal measure of rates.

Just north of Missouri lies the state of Iowa. To the untutored mind there would seem to be no reason why traffic of the same class should move within the state of Iowa for a less charge than within the state of Missouri. Yet the maximum charge under the Iowa distance tariff for hauling first class merchandise 200 miles is 40 cents,

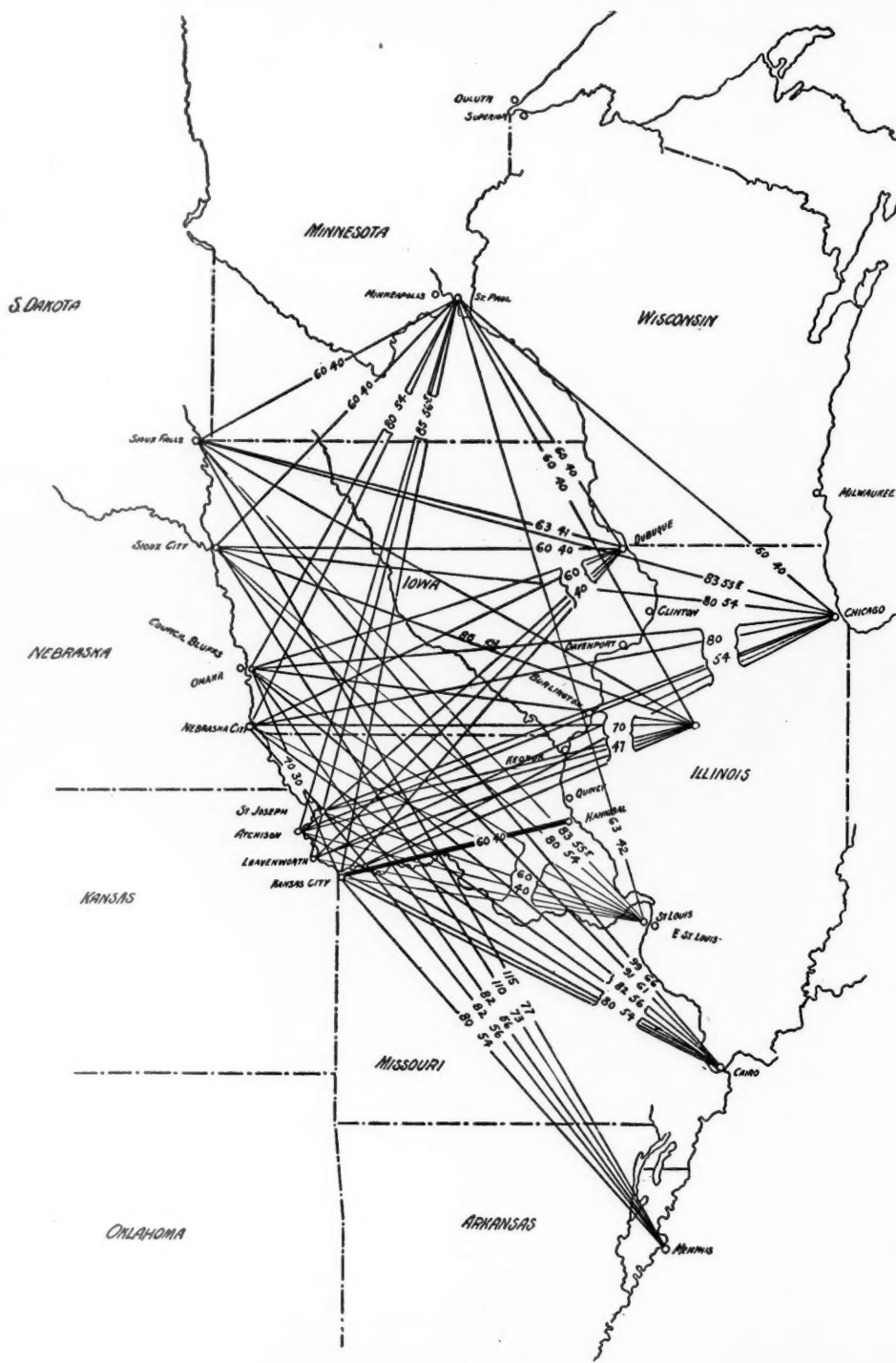


Fig. 4.

Broad line indicates short line distance of 199 miles across state of Missouri, between Hannibal and Kansas City, which measures and controls all western rates. Left-hand figures are present rates. Right-hand figures indicate approximate rates were Missouri commission to prescribe Iowa scale as the Missouri maximum.

as against 60 cents fixed by the Missouri tariff. The railroads in Iowa must haul the same class of merchandise 350 miles to be entitled to charge 60 cents, but, significantly enough, the 350 miles measure the distance in Iowa between the Mississippi and Missouri rivers, so that the rate between the two base lines is the same in both states. Should Missouri adopt the Iowa scale, the Missouri rate from the Mississippi river to the Missouri river, between all the points in Missouri that we have been considering, would, for the reasons already given, at once become 40 cents, regardless of distance.

The effect within the state of Missouri, however, is only the be-



ginning. The rate between the Mississippi and Missouri rivers being, as previously explained, one of three factors of a through adjustment from points of production in the East; the rates from the East to all Mississippi river crossings being the same; there being competitive routes from the East to all Missouri river points passing through all of these Mississippi river crossings; and the merchants and manufacturers in the Mississippi river cities maintaining trade relations with all of the Missouri river cities and with the territory reached through them; it follows that the rate between Dubuque, Iowa, and Kansas City, Mo., cannot be higher than the rate between Dubuque and Council Bluffs (both points within the state of Iowa); nor can the rate between St. Louis, Mo., and Omaha, Neb., be higher than the rate between St. Louis and Kansas City or between St. Louis and St. Joseph (movements wholly within the state of Missouri).

Thus from the act of the Missouri commission in reducing its

charge for its haul of 488 miles between St. Louis and Omaha, through Missouri, Kansas and Nebraska; and in like manner the rate of the Illinois Central Railroad for its haul of 703 miles between the same points, through the states of Missouri, Illinois and Iowa. (See the map.)

Thus, within the territory enclosed by the Illinois Central, Missouri Pacific and Rock Island as outlined on the map, any reduction made by the Missouri commission in the class rates for the 200-mile distance between Hannibal, Mo., and Kansas City, Mo., has the effect of bringing all rates to the level so fixed, not only between the crossings themselves but, with very slight exceptions, between all intermediate points.

This, again, is but a preliminary glimpse at the inevitable results of this action of the Missouri State Commission.

The first class rate from Chicago to the Missouri river has for many years been 20 cents per 100 lbs. higher than the rate from

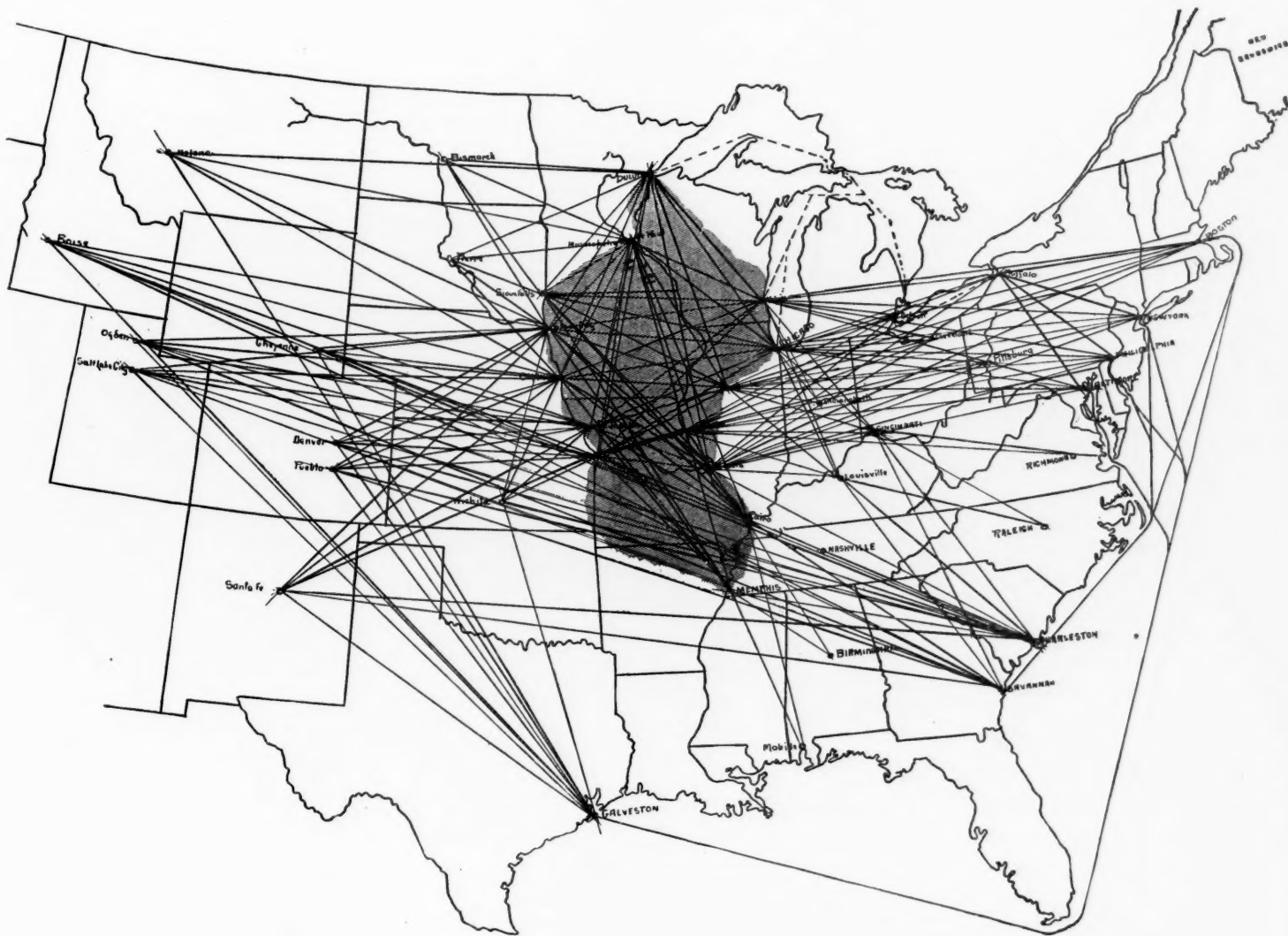


Fig. 5.

The shaded field indicates the territory immediately affected by any change in the Missouri Commission's maximum rate for the controlling distance of 199 miles between the Mississippi river and Missouri river base lines. If the controlling factor in western trunk line territory be reduced by state action in Missouri, the entire revenue on east and west business falls automatically in proportion. The water lines indicate the principal through rates operated by the rail and water carriers, which move upward or downward automatically with any fluctuation in the all-rail rates.

distance tariff from 60 cents to 40 cents for 200 miles, the following results directly flow:

(a) The local *Missouri* rate from points on the Mississippi river to points on the Missouri river, regardless of mileage, is reduced from 60 cents to 40 cents;

(b) The local *Iowa* rate from points on the Mississippi river to points on the Missouri river (say Clinton to Council Bluffs, 350 miles) is reduced from 60 cents to 40 cents;

(c) The *interstate* rate from points on the Mississippi river in Missouri to points on the Missouri river in Iowa or Nebraska (say St. Louis to Council Bluffs or Omaha) is reduced;

(d) The *interstate* rate from points on the Missouri river in Missouri to points on the Mississippi river in Iowa (say Kansas City to Davenport) is reduced.

Not only this, but this Missouri commission rate for 200 miles fixes the maximum rate which the Missouri Pacific Railway may

the Mississippi river. The competitive adjustment would require that there be no greater difference under the new scale. Indeed, the rates from the seaboard to Chicago and the Mississippi river remaining as at present, it is doubtful if Chicago and the routes through Chicago could compete should the present arbitrary difference be maintained under the reduced adjustment. The present rate of 80 cents, first class, from Chicago, is one-third higher than the rate from the Mississippi to the Missouri river. It is probable that not more than one-third greater would be practicable under the lowered scale, which would make the first class rate from Chicago 54 cents per 100 lbs.

Peoria must be maintained at one-half the difference between Chicago and the Mississippi river. Milwaukee must be kept on the same rate basis as Chicago. The rates from Minneapolis and St. Paul must be kept the same as Chicago to the upper Missouri river crossings (Omaha, Council Bluffs and Nebraska City), and 5 cents

higher than Chicago to the lower crossings (St. Joseph, Atchison, Leavenworth and Kansas City). Duluth takes fixed arbitraries above St. Paul. The intervening territory in Wisconsin, between Milwaukee and St. Paul, is built on arbitraries over either Chicago, Milwaukee or St. Paul, and would call for readjustment accordingly. From Memphis, Tenn., not higher than Chicago rates can be maintained to lower Missouri river crossings, and to the upper crossings the first class rate from Memphis cannot be more than 2 cents higher than Chicago. To Sioux City the rate from Chicago, St. Louis and Peoria must be kept the same as from Chicago to Omaha. The first class rate from Memphis to Sioux City is to-day 30 cents higher, and from Minneapolis and St. Paul 20 cents less, than from Chicago to Sioux City, and the same percentage relation must be maintained on the lowered scale.

The immediate result, then, of the fixing by the Missouri Commission of a maximum charge of 40 cents, first class, for the distance of 200 miles between Hannibal, Mo., and Kansas City, Mo., is to fix

interstate movements throughout the whole territory pictured in the outline.

The illustration thus far deals only with the change in rates on business which may be termed purely local to the territory immediately embraced in the illustration—that is, business which has both origin and destination within the territory. We have not yet touched upon that volume of eastern business to the Missouri river cities, to St. Paul and Duluth, and to the territory beyond as far West as the states of Utah, Idaho and Montana, or to the Southwest, including the state of Texas and territory of New Mexico. Yet the rates on this business are quite as vitally involved. The competitive adjustment between Chicago, Peoria, Memphis, the Mississippi river, and the head of the lakes, as previously described, was originally evolved and has since been maintained in a measure to permit this merchandise to move freely by all routes to this trans-Missouri, northwestern and southwestern territory. Whenever the western factors of the through rates to this territory are reduced,



Fig. 6.

the rates for all routes shown on the accompanying map of what is termed western trunk line territory:

The foregoing outline illustrates only the adjustment of first class rates. In Western Classification territory there are five numbered and five lettered classes, and the other classes all bear a certain percentage relation to the first class rates. This is true to the extent that any considerable reduction in the rate on first class involves necessary proportionate reductions in the rates on other classes—the severity of any such reduction lessening, of course, as the rates themselves grow less; but the rates on all classes must go down if one goes down, so that the same fixed relation between the classes may be maintained on the lower as on the higher basis.

Similarly, the outline only illustrates the change in the adjustment between the principal basing points in western trunk line territory. But around these basing points are grouped all the adjacent cities and towns; so that an adjustment once reduced from Chicago, or Peoria, or the Mississippi river to the upper or lower Missouri river points, a corresponding reduction results from all points, both of origin and of destination, held common with these basing points. So the reductions become automatic covering all

the rates on such through business fall simultaneously with the rates on the local business.

Merchandise for this western territory moves from the East by every conceivable route. Every all-rail line and every conceivable combination of rail lines publish the rates. During lake navigation daily boats carry this merchandise to Chicago, Milwaukee and the head of the lakes. It is handled by steamer in connection with rail lines from every South Atlantic port from Norfolk to Jacksonville. There is a steamer load despatched daily from New York and given to the rail lines at the port of Galveston, Texas. The rate fixed by the authority of the state of Missouri, between Hannibal and Kansas City, and based on purely local considerations, has its leveling effect upon the rates on every pound of this vast traffic. The next map shows the ultimate reach of the rate-making power of Missouri.

It is true that the illustration has proceeded thus far on the assumption that Missouri might make a reduction in its existing class rates, and not on the fact that such reduction has been made. But Iowa has precisely the same control over interstate adjustments that the illustration demonstrates Missouri to have, and as mat-



ter of fact East and West class rates are what they are to-day because Iowa some years ago prescribed 60 cents as the maximum charge, first class, for the haul within its borders between the Mississippi and the Missouri rivers. The Iowa distance tariff of 1887 actually measures to-day the revenues of the interstate railroads on all interstate freight passing into or out of or beyond that state.

Besides, Missouri has actually made radical reductions in other rates that illustrate as well the principle of our contention. The legislature of 1905 ordered drastic reductions of rates on grain, flour, lime, salt, cement, stucco, lumber, agricultural implements, furniture, wagons and live stock, and the legislature of 1907 added

100 lbs. on all grain. The state's action also calls for a reduction of a half cent per 100 lbs. in the proportional rate on wheat between Kansas City and Hannibal. This proportional rate of 9 cents is the rate applied on all wheat coming from beyond the Missouri river, and, as in the case of the class rates, it is the pivotal rate in the whole adjustment. If the legislature's action is finally upheld, a readjustment of the whole rate fabric on western grain will result. There is no more sensitive adjustment in existence than the grain rates. No single part of any of the through rates can be disturbed without disturbing the revenue on a large part of the whole movement.

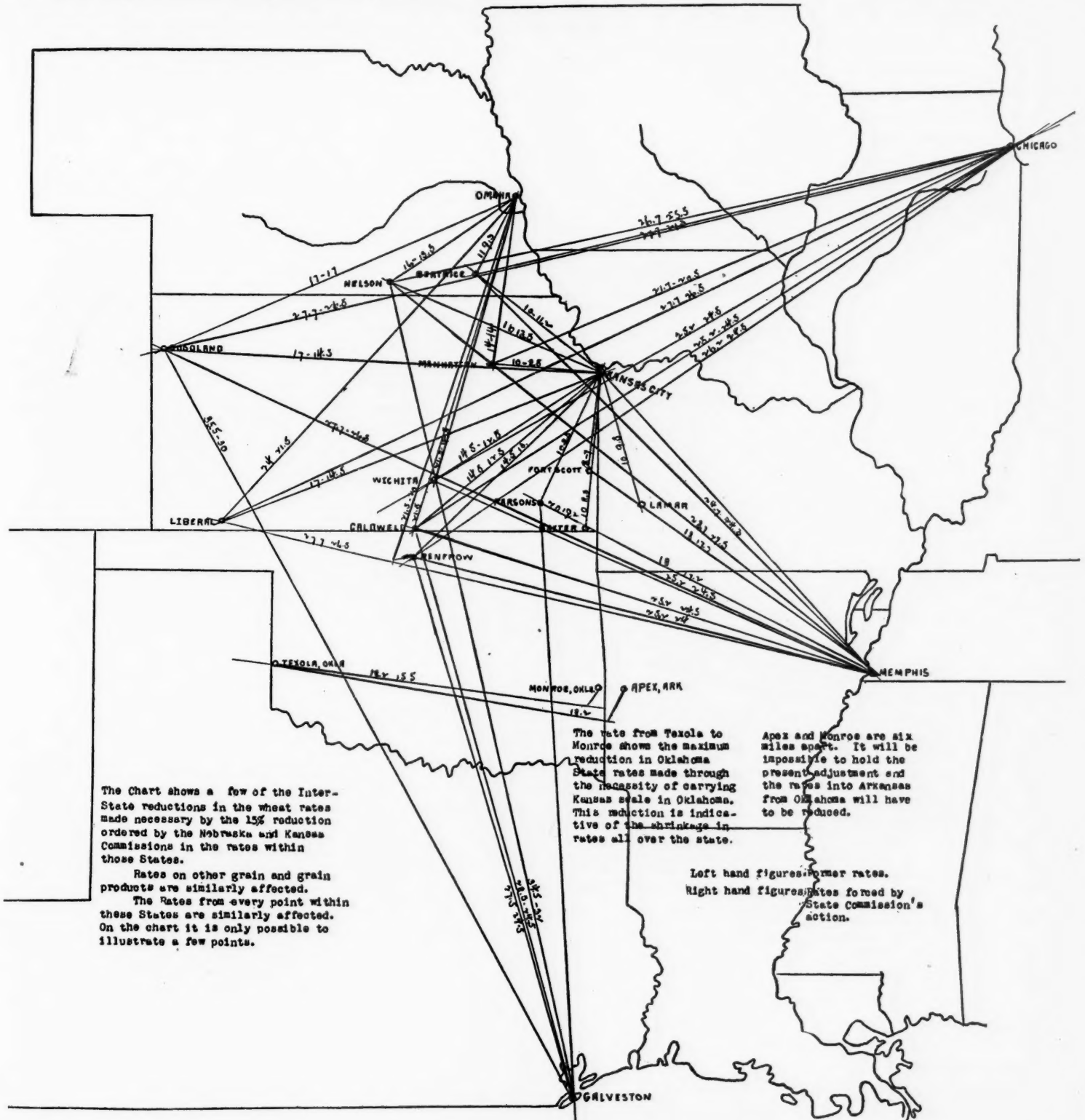


Fig. 7.

stone, gravel and other commodities. The rates have not been published, as the constitutionality of the legislation is in question before the courts, but if the state's right to order the reductions is finally established, the interstate rates on these bulk commodities, which constitute a large percentage of the carload tonnage of all western carriers, will come down with them.

The reductions which will result in rates on grain will illustrate. The short line distance rate between the Missouri and Mississippi rivers will be reduced from 13 cents per 100 lbs., on wheat, and 12 cents per 100 lbs. on corn and other grain, to 8½ cents per

Competition and market conditions require that the rates on grain from the states of Kansas and Nebraska shall be so adjusted that the grain raised in those states can move eastward freely through either of the primary markets at the Missouri river, Kansas City or Omaha. When these markets are reached, not alone the grain markets of the United States, but the foreign markets as well must be open to the producer, so that the Nebraska or Kansas producer may have the benefit of the best prevailing market price of the world to-day; and the adjustment must be maintained from day to day so that the large grain buyers may take the surplus grain

into elevator storage, not only at the Missouri river, but at the large storage points at the Mississippi river, the Ohio river, the Lake ports, the milling centers, and the Atlantic and Gulf seaboard, with the full assurance that when the demand makes eastern or southern shipment desirable he will have a parity of rates in either direction through any market. If the reduced rates are finally enforced the material reductions within the state will be insignificant compared with the automatic reductions in the interstate adjustment which must follow. The same reduction must be made from Omaha, not only to St. Louis but to the other Mississippi river crossings; to Peoria and Chicago, the gateways to the Central states; to Louisville, Evansville, Cairo and Memphis, the market points for all the Southeastern states; to Little Rock, Texarkana, Fort Worth, Dallas and Shreveport, the principal market gateways for the states of

lower than the local rates. The accompanying chart only illustrates the direct reductions in the existing proportional rates:

#### KANSAS AND NEBRASKA.

During the year 1907 the Railroad Commission of Kansas forced a reduction of 15 per cent. in the existing rates on grain within the state. A reduction in grain rates always applies as well on flour, meal and other grain products. The Nebraska Commission forced a 15 per cent. reduction in state rates, not only on grain and grain products, but on live stock, coal, lumber and fruits and vegetables.

Kansas and Nebraska do not consume a hundredth part of what they produce, and the great bulk of the commodities consumed within these states is produced outside of them. The freight destined from points of origin within either state and moving under the state's mileage rates to points of consumption within the state, is



Fig. 8.

This chart shows the reduction in interstate rates which would follow a reduction of 5 cents, in the Texas railroad commission's first-class rate from Galveston to Waco. (The rates shown apply only from the basing points.) All other towns group around these and the reduction from all is the same as from the basing point. Upper figures: Rates at present in effect. Lower figures: Rates which would apply following the above-mentioned reduction.

Arkansas, Louisiana and Texas; and to Minneapolis, the largest of the milling centers. Any reduction in the rate to the Mississippi river and Chicago means just that much reduction in the revenue on grain moving to Boston, New York, Philadelphia, Baltimore and Newport News for export, as these rates are all made on the Mississippi river combination. And when these rates go down, a similar reduction is forced in the rate to Pensacola, Fla., Mobile, Ala., New Orleans, La., and Port Arthur and Galveston, Tex., for export.

It has never been found feasible to carry local and proportional rates on the same basis, and there is therefore the probability of further reduction in the proportional basis. To what figure the proportional rate on wheat across Missouri might fall as the result of carrying a local rate of  $8\frac{1}{2}$  cents, is, of course, problematical. The rates up to this time have always been maintained about 4 cents

as nothing to that which moves to points beyond the state. That is to say, nearly all the traffic of both the states is interstate, and subject to the influence of the competitive interstate rate adjustments.

The products of Kansas and Nebraska find their primary markets (Kansas City, Kan., and Omaha, Neb.,) on the Missouri river at the extreme eastern boundary of the state, and the state regulation fixes the rate at which the product is hauled from points of production to these primary markets, no matter what the ultimate destination of the product may be. As a result, the 15 per cent. reductions in the grain rates required by both state commissions have called for a flat reduction of just that amount in all interstate rates, and a corresponding shrinkage in railroad revenues on practically all of the grain raised in both the states.



A contingent result is a horizontal reduction in the rates on Oklahoma grain. The Choctaw line of the Rock Island operates in Oklahoma under a charter which provides that its rates in that state must not be higher than they are in the states from which it enters Oklahoma. The line enters Oklahoma from Kansas, as well as from Arkansas, and the charter provision required an immediate adjustment of the Oklahoma rates on the Kansas scale. With the Oklahoma rates on the Kansas basis it was found impossible to maintain the adjustment formerly prevailing from points in southern Oklahoma to points in Texas, and a readjustment there was necessary. Similar reductions of the rates to Arkansas points will be required.

This situation clearly illustrates the interdependence of state and interstate rates. The accompanying chart will give a partial illustration of the situation. It can, of course, picture the effect only at a few points. The reductions are general, affecting every point:

#### TEXAS.

In Texas, state regulation of rates is deliberately designed to control the rates on interstate business both into and out of the state. There is, from the standpoint of the state, excellent reason for this policy; for, aside from its timber and a portion of its grain, little which Texas produces is consumed within the state, and the bulk

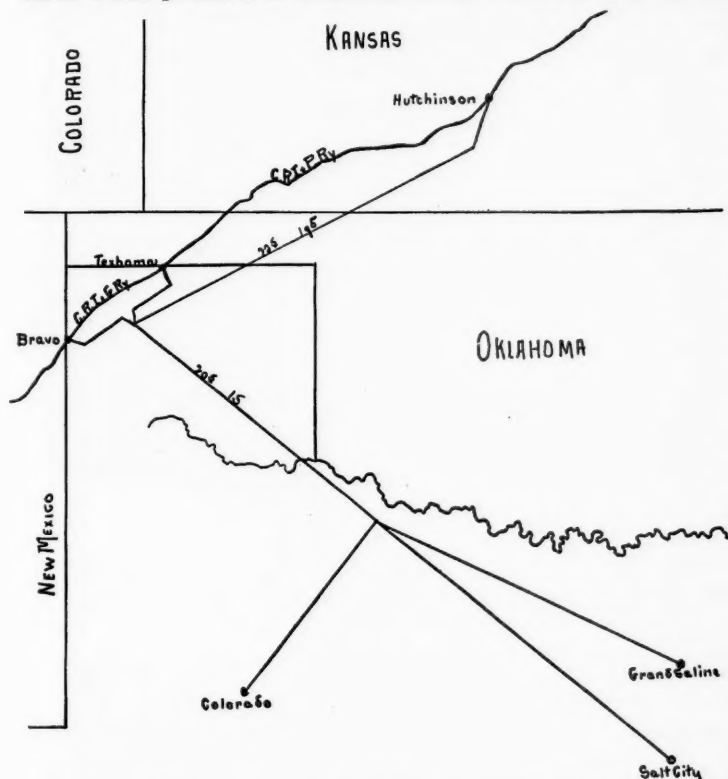


Fig. 9—Texas Commission's Emergency Rate on Salt.

Average mileage—From Hutchinson, 300; from Colorado, 660; from Grand Saline, 525; from Salt City, 690.

of the food stuffs, wearing apparel and manufactured articles which its citizens consume or use are imported from other states.

The state commission has always conceived it to be to the state's interest to link its fortunes with the coastwise steamship lines rather than with the all-rail carriers reaching the state through its northern gateways. Consequently the commission has made the port of Galveston the radiating point in its adjustment. The class rates from the eastern seaboard have always been made the exact combination of the steamship rates from New York, Boston, Philadelphia and Baltimore to the port of Galveston, plus the commission's local rates thence to every point in the state. This has forced the rail carriers to group all the producing territory west of seaboard territory, and to maintain a relative adjustment calculated to permit these territories to market their products in Texas in competition with the rates from the seaboard fixed for the rail carriers both in and outside the state by the Texas commission and the steamship lines.

It necessarily follows that whenever the Texas commission reduces a rate from Galveston the revenue of the state carrier on all Texas business originating at the Atlantic seaboard is lowered and the interstate carriers are compelled to make corresponding reductions from every other basing point. The immediate effect of a reduction of 5 cents in the commission's first class rate from Galveston to Waco is outlined in the accompanying chart:

Texas is above all a cotton-growing state. The wealth of its farming communities and the business of its cities is founded on the production and marketing of this staple. The revenues of the carriers within the state are largely dependent upon the movement of the cotton crop. Texas produces one-quarter of all the cotton

grown within the United States. It has, however, no cotton-spinning industry worthy the name. Probably 99 per cent. of the cotton grown in the state is sent to New England and southeastern spinning points and to foreign countries. The revenues of the carriers on all this interstate and foreign cotton freight are absolutely dependent upon the rates fixed by the railroad commission of Texas to the port of Galveston.

Three years since, the commission ordered a reduction in cotton rates of 5 cents per 100 lbs., or \$1 per ton. The movement from Texas to interstate and foreign destinations in the fiscal year ending June 30, 1906, was a million and a half tons. The direct result to interstate carriers from this one act of the Commission has been an annual shrinkage in their revenues of something like a million and a half of dollars.

A cardinal principle in the three principal classification territories is that valuable commodities such as dry goods, notions, boots and shoes, hats, etc., shall take first class rates, whether the goods are shipped in carloads or in less than carload quantities. There is no voluntary variation from this in any interstate adjustment. The principle has frequently been reviewed without disapproval by the Interstate Commerce Commission. The Texas commission, however, has taken the opposite view, and in its state classification has fixed class "A" basis on these commodities when shipped in carload quantities. This action on their part has no force or effect so far as concerns state traffic. None of these commodities are manufactured within the state and no house in the state jobs them in carload quantities. The state commission's action does, however, reduce the interstate rate on these commodities from New York to interior Texas towns 37 cents per 100 lbs. in carload lots.

That the Texas commission exercises its rate-making powers with deliberate intent to control the interstate rates for the benefit of its industries appears from the following illustration.

The Rock Island has a line running southwest from the state of Kansas, passing diagonally across the Panhandle of Texas into New Mexico and on to El Paso. There are large salt industries on this line at Hutchinson, Kan., and in the year 1905 the Rock Island, being asked to establish a reasonable rate from Hutchinson into its Panhandle towns, published an average rate of 19½ cents. The average distance is about 300 miles. There are salt plants of considerable importance at Grand Saline, Salt City and Colorado, Texas, and under the state commission's orders, the Rock Island, in connection with other lines, had in effect an average rate of 20½ cents per 100 lbs. from these state salt plants to the Panhandle towns. The average haul to these points is from Grand Saline, 525 miles; from Colorado, 660, and Salt City, Texas, 690 miles. When the Rock Island's interstate rate came to the attention of the Texas commission, it ordered the Rock Island's Texas line to non-concur in the reduction, threatening that if the interstate rate were allowed to stay in, they would compel the state carriers to haul salt from these state plants to the Panhandle points for 15 cents per 100 lbs. Needless to say, the interstate rate was withdrawn, and it remains today at the Texas maximum rate of 22½ cents. The map illustrates the situation.

#### ILLINOIS.

Recent reductions in class rates in Illinois have forced reductions of the interstate rates between St. Louis, Hannibal, Quincy, Keokuk, Davenport and Dubuque, and will eventually force similar reductions in rates between intermediate local points either wholly interstate or wholly within other states than Illinois.

#### ARKANSAS.

The Arkansas commission has prescribed a full line of class and commodity rates which produce an effect on all the rates on merchandise brought into the state from points beyond, similar to the results of the Texas commission's regulation of the rates in that state.

#### MINNESOTA.

The Minnesota commission has fixed a scale of class rates within the state which recently required the leveling down of all rates from Minneapolis, St. Paul and Duluth to Iowa and Dakota points. It was with respect to this situation that Judge Lochren said in the case before him involving the validity of these rates:

"It would seem to be very difficult to avoid . . . the conclusion that these rates fixed in respect to Minnesota do necessarily and directly affect interstate commerce. . . . I have no doubt that Congress might very properly, under the constitutional provision giving it the entire power of control over interstate commerce, assume control of the avenues of interstate commerce of the railroads which are engaged in interstate commerce, and of all rates which are collected by those railroads, whether within the states or without the states, because the matter of those rates would affect these avenues of interstate commerce, and might affect their ability to continue as avenues of interstate commerce."

And as to this argument, urged before the Supreme Court in the Minnesota rate case, recently decided, the opinion of Mr. Justice Peckham says:

"Still another Federal question is urged growing out of the assertion that the laws are, by their necessary effect, an interference with and a regulation of interstate commerce, the grounds for which assertion it is not now necessary to enlarge upon. The question is not, at any rate, frivolous."

### Reinforced Concrete Trestle on the Burlington.

The reinforced concrete trestle illustrated herewith was recently completed on the St. Louis-Hannibal line of the Burlington. The crossing of Salt river, about 100 miles north of St. Louis, is a three-span through truss bridge, with a trestle approach on the north nearly 500 ft. long. When it became necessary to renew this trestle, which was built of timber, it was decided to substitute reinforced concrete.

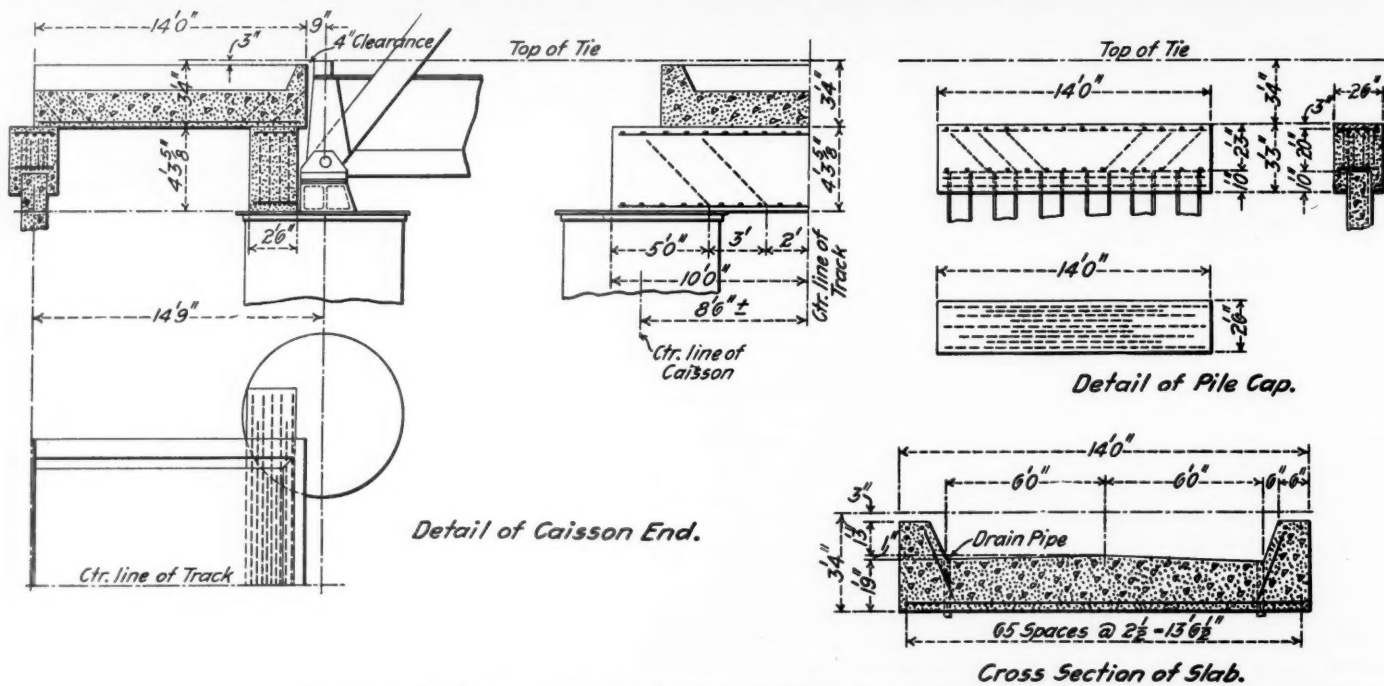
The structure had to be put up under traffic. A temporary trestle was built by driving piling on each side of the old bridge and capping it longitudinally. The stringers of the old bridge, together with some new material, were then placed across this and the rails

In driving the piles were capped with an 8-in. rubber cushion, and although, sometimes, several hundred blows were required, and in some cases the full 24-ft. drop of the hammer was used, none of the piles was injured. They were driven in gravelly sand and the penetration was from 14 to 16 ft.

After the piles were driven, molds were put around the tops and the caps cast in place. When these had set sufficiently, the forms for the slabs were put up and these likewise built in place. Building paper was put in the joints between slabs. There is no other provision for expansion. A pier, resting on wooden piling, is placed at every fifth span to take the longitudinal thrust. The end of the steel span adjoining the trestle rests on caissons. The floor slab of the trestle rests on a reinforced concrete beam, 4 ft. 3½ in. deep, on



Reinforced Concrete Trestle Approach to Salt River Bridge.



Details of Reinforced Concrete Trestle; Chicago, Burlington & Quincy.

spiked directly thereto. The old bridge was removed from underneath this structure and the new one built in its place without interference with traffic. This method is more expensive than is the case where the floor slabs are cast in a yard nearby and set in the bridge by a derrick, and its use is justified only where trains are frequent.

The north approach is 477 ft. 6 in. long. The bents are spaced 14 ft. centers and there are six piles to the bent; these piles, which are 22 ft. long, were molded on their sides. They are reinforced with eight ½-in. corrugated steel bars, wound spirally with No. 12 steel wire. They are 16 in. square at the top, are chamfered 3 in. on the corners and taper 8 in. in 30 ft. They were driven, for the most part, with an ordinary road pile-driver having a 3,000-lb. hammer.

top of the caissons. The south approach has only three spans and is 42 ft. 9 in. long.

In the West and South there are many miles of wooden trestle bridges carrying tracks over overflow water only. They are a constant expense for maintenance and renewal, many of them being in swampy land, affording poor foundations. The advantages of concrete construction in such situations are obvious. Its low first cost—from \$25 to \$30 per foot of single track—the complete immunity from fire, the permanent character of the structure and the freedom from maintenance cost should commend it to maintenance engineers.

The Salt river trestle was designed by C. H. Cartlidge, Bridge Engineer of the Burlington, and was built by company forces.



## The Pennsylvania's New Rail Sections and Specifications.

The accompanying rail sections and the following specifications are the results of the work of the rail committee of the Pennsylvania Railroad. The members of the committee are: Theo. N. Ely, Chief of Motive Power, Lines East and West, Chairman; A. C. Shand, Chief Engineer, Lines East; L. R. Zollinger, Engineer Maintenance of Way, Lines East; A. W. Gibbs, General Superintendent Motive Power, Lines East; C. B. Dudley, Chemist, Lines East; T. H. Johnson, Consulting Engineer, Lines East; Robt. Trimble, Chief Engineer Maintenance of Way, Lines West; W. C. Cushing, Chief Engineer Maintenance of Way, Lines West; J. C. Bland, Engineer of Bridges, Lines West; D. F. Crawford, General Superintendent Motive Power, Lines West.

## Chemical Composition.

1. The steel of which the rails are rolled shall conform to the following limits in chemical composition:

|                  | Bessemer.    |                      |              |
|------------------|--------------|----------------------|--------------|
|                  | Lower limit. | Desired composition. | Upper limit. |
| Carbon .....     | 0.45         | 0.50                 | 0.55         |
| Manganese .....  | 0.80         | 1.00                 | 1.20         |
| Silicon .....    | 0.05         | 0.12                 | 0.20         |
| Phosphorus ..... | ....         | ....                 | 0.10         |
|                  | Open-hearth. |                      |              |
|                  | Lower limit. | Desired composition. | Upper limit. |
| Carbon .....     | 0.70         | 0.75                 | 0.80         |
| Silicon .....    | 0.05         | 0.12                 | 0.20         |
| Manganese .....  | ....         | ....                 | 0.80         |
| Phosphorus ..... | ....         | ....                 | 0.03         |

## Process of Manufacture.

2. Ingots shall be kept in a vertical position until ready to be rolled, or until the metal in the interior has had time to solidify.
3. No "bled" ingots shall be used. ("Bled ingot"—one from

the leading and finishing passes, nor after they leave the finishing pass.

## Mechanical Requirements.

7. The name of the maker, the weight and type of the rail, and the month and year of manufacture shall be rolled in raised letters and figures on the side of the web, and the number of the heat shall be plainly stamped on each rail where it will not subsequently be covered by the splice bars. A letter shall be stamped on the web to indicate the portion of the ingot from which the rail was rolled.

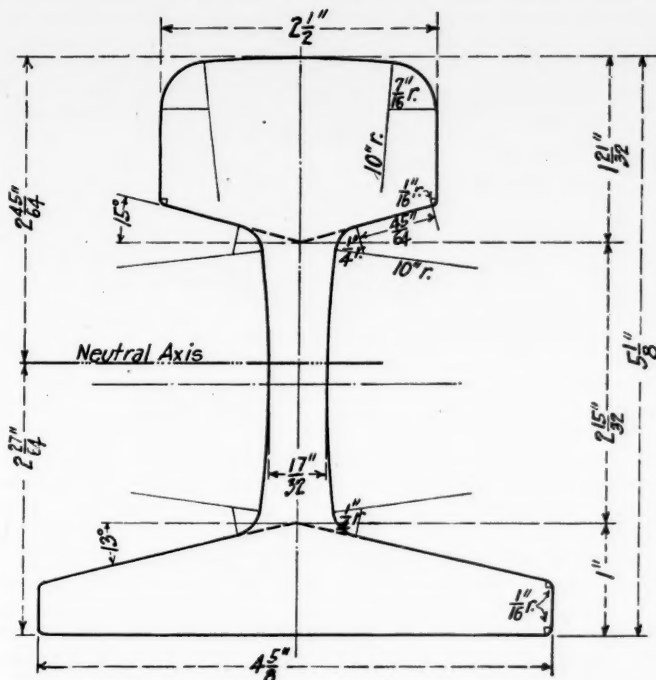
8. The section of rail shall conform as accurately as possible to the templet furnished by the railroad company. A variation in height of  $\frac{1}{64}$  in. less or  $\frac{3}{32}$  in. greater than the specified height, and  $\frac{1}{16}$  in. in width of flange, will be permitted; but no variations shall be allowed in the dimensions affecting the fit of the splice bars.

9. The weight of the rails specified in the order shall be maintained as nearly as possible, after complying with the preceding paragraph. A variation of one-half of 1 per cent. from the calculated weight of section, as applied to an entire order, will be allowed.

10. The standard length of rails, at a temperature of 60 deg. F., shall be 33 ft. Ten per cent. of the entire order will be accepted in shorter lengths, varying as follows: 30 ft., 27½ ft. and 25 ft., and all No. 1 rails less than 33 ft. long shall be painted green on ends. A variation of  $\frac{1}{4}$  in. in length from that specified will be allowed.

11. The rails must be free from injurious mechanical defects and flaws; shall be sawed square at the ends, a variation of not more than  $\frac{3}{32}$  in. being allowed; and burrs shall be carefully removed.

12. The rails shall be smooth on the heads, straight in line and surface, and without any twists, waves or kinks; particular attention being given to having the ends without kinks or drop. The



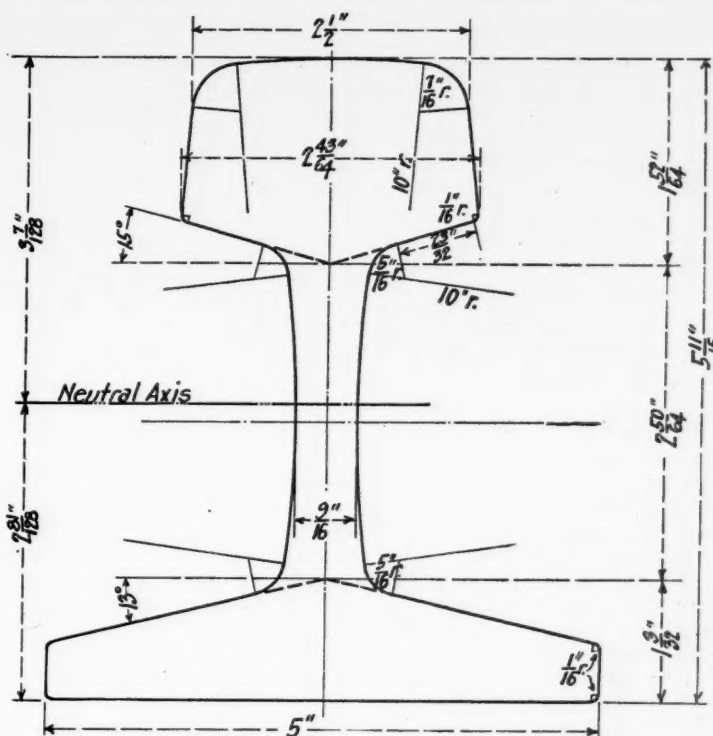
85-lb. Rail; Pennsylvania Railroad.

the center of which the liquid steel has been permitted to escape.)

4. There shall be sheared from the end of the bloom formed from the top of the ingot sufficient discard to insure sound rails. (All metal from the top of the ingot, whether cut from bloom or rail, is the top discard.)

5. In reheating, care shall be taken to avoid burning the steel, and under no circumstances shall a "cinder heat" be used. ("Cinder heat"—one in which the scale on the sides of the ingot becomes fluid.)

6. The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws, for a rail 33 ft. in length, of  $\frac{6}{16}$  in. for 85-lb. section, and  $\frac{6}{16}$  in. for 100-lb. section. These allowances to be decreased at the rate of  $\frac{1}{100}$  in. for each second of time elapsed between the rail leaving the finishing rolls and being sawed. The bars shall not be held for the purpose of reducing their temperature, nor shall any artificial means of cooling them be used between



100-lb. Rail; Pennsylvania Railroad.

hot straightening shall be carefully done, so that gagging under the cold presses will be reduced to a minimum. Any rail coming to the straightening presses showing any sharp kinks or greater camber than that indicated by a middle ordinate of 4 in. in 33 ft. will be at once marked as a No. 2 rail, and only accepted as such. The distance between the supports of rails in the straightening presses shall not be less than 42 in.

13. Circular holes for splice bars shall be drilled to conform accurately in every respect to the drawing and dimensions furnished by the railroad company, and must be free from burrs.

## Tests and Inspection.

14. One drop test shall be made on a piece of rail not less than 4 ft. and not more than 6 ft. long, selected by the inspector from each heat of steel, from any position in the ingot. The test piece shall be placed head upwards on solid supports, 5 in. radius, 3 ft.

between centers, and both 85-lb. and 100-lb. sections shall be subjected to an impact test from a weight of 2,000 lbs., falling 15 ft. The deflection for No. 1 classification rails must not exceed that indicated by a middle ordinate of 2 in. in 3 ft. for 100-lb. section, and 2½ in. for 85-lb. section. Test pieces shall be tested to destruction. The temperature of the test pieces shall be between 60 and 120 deg. F.

(a) If a test piece breaks without showing physical defect, all rails made from that heat shall be rejected absolutely.

(b) If, however, the test piece broken under test "a" shows physical defect, the top rail from each ingot of that heat shall be rejected; and

(c) A second test shall then be made of a test piece selected by the inspector. If this second test piece breaks, the remainder of the rails of the heat shall also be rejected. If this second piece does not break, the remainder of the rails of the heat will be accepted as either No. 1 or No. 2 classification, according as the deflection is less or more, respectively, than the prescribed limit.

(d) If the test piece, test "a," does not break, but when tested to destruction shows pipe, the top rail from each ingot shall be rejected. The remainder of the rails of the heat will be accepted as either No. 1 or No. 2 classification, according as the deflection is less or more, respectively, than the prescribed limit.

(e) If the test piece, test "a," does not break, and when tested to destruction does not show pipe, the rails of the heat will be accepted as either No. 1 or No. 2 classification, according as the deflection under test "a" is less or more, respectively, than the prescribed limit. Note—The drop test and the deflection requirements may be modified if considered advisable by the railroad company.

15. The drop-testing machine shall have a tup of 2,000 lbs. weight, the striking face of which shall have a radius of not more than 5 in. The anvil block of the drop testing machine shall weigh at least 20,000 lbs., and the supports shall be part of, or firmly secured to, the anvil. The foundations for the anvil block shall be such as will meet the approval of the railroad company.

16. No rails shall be accepted which contain any physical defects that impair their strength.

17. Rails improperly drilled or straightened, or from which the burrs have not been properly removed, shall be rejected, but may be accepted after being properly finished.

18. No. 2 rails to the extent of 5 per cent. of the whole order will be received. All rails accepted as No. 2 rails must have the ends painted white, and must be kept separate from No. 1 rails, and be shipped in separate cars.

19. Rails will be accepted and billed according to actual weights.

20. All rails must be loaded in the presence of the inspector.

21. The makers shall furnish the inspectors with the carbon determination of each heat, and, also, two complete analyses which shall represent the average steel of each day's work, before the rails are shipped. These analyses will be checked from time to time by the railroad company's chemist, and, on request of the inspector, the makers shall furnish a portion of the test ingot for check analyses.

22. Inspectors representing the railroad company shall have free entry to the works of the makers at all times when the contract is being filled, and shall have reasonable facilities afforded them by the makers to satisfy them that the finished material is furnished in accordance with these specifications. All tests and inspection shall be made at the place of manufacture, prior to shipment.

#### The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

#### XV.

##### Agreements Among Ocean Carriers to Control Rates.

As might be expected, the freedom of the sea conduces to variation in the forms of agreement among sea carriers. At least four kinds of agreements are clearly discernible: (1) division of territory; (2) freight pooling; (3) pooling of profits; (4) "conference" or agreement to maintain rates.

1. Division of territory, although not the most common, is probably the simplest form of agreement, as it is the easiest to operate. Each party is, within limits, free to do as it chooses within its own territory. The agreement between the German companies and the Morgan syndicate makes a precise division of territory, by limiting future new services and setting the number of sailings that might be made on some existing services. In the North Sea traffic, Wilson's of Hull, the great rivals of the United Danish Lines, agree with their rivals as to which ports each shall serve, and when they disagree the threat of either party to compete at all points is a strong argument for peace, as it was also in the recent (December, 1905) quarrel—or ostensible quarrel—between the Hamburg-American and North German Lloyd companies. There are many divisions of territory that are tacit rather than formal. A line performing a certain service desires to add to or extend its service, but fears to do so knowing that the move will be regarded as a prac-

tical declaration of war and treated accordingly. This is probably the commonest of all causes of rate wars. A new carrier enters a rich field for a share of the trade and a contest ensues.

One of the commonest ways of ending a rate war is for the contestants to divide up the territory. The following is an example: During 1902 and 1903 the trade from New York to Hayti and Cuba was competed for by the Hamburg-American Line and the Cameron Line. This was settled and competition ended by the Cameron Line withdrawing their ships from Hayti, but continuing their Mexico and Cuba services. The owners of the Cameron Line further acted as agents for the Hamburg company in Hayti, but the Hamburg company's ships did the carrying.

2. Freight pooling achieves a similar result by (a) the common method of alternate sailings or by (b) the more unusual method of actual division of the traffic on a basis of percentage or kinds of traffic.

(a) Alternate sailings is one of the most, if not the most, widespread of all forms of line agreements. It is simple in its development and really was the origin of line traffic on many routes. Two or three merchants who were in the habit of sending an occasional sailing vessel for themselves and others, naturally chose different times for the despatch of their ships, because there was then more freight offering. They almost inevitably worked out something as a schedule.\* The same advantage holds true when two or more lines are running on the same route. As the advantages of this manifestly increase with the length of the route, it is natural that it should be prevalent in the trade to South America, Africa and the Orient.

To the Argentine Republic, one French and two English lines give a uniform rate with alternate sailings and exchange of passenger tickets. To the west coast of South America the Hamburg-American and the Hamburg-South American companies alternate the schedule and increase their ships together. But these lines have even a closer pooling alliance. In the Oriental trade two French lines operate together, taking turns, and the two great German companies have tried about all forms of combinations. This service has been double, consisting of the Imperial Mail line and a cargo line, the two companies joining in furnishing the vessels for these. This was followed by a period during which the Hamburg company managed the freight line and the Bremen company the mail line, each contributing ships to both. This was satisfactory to neither party, and by a Hamburg conference in November, 1903, it was agreed that the Bremen company should furnish as well as manage the mail line, and the Hamburg company the cargo line. The companies then exchanged vessels and agreed not to antagonize each other in this trade. A half-dozen companies along the Dalmatian coast recently made a similar arrangement by which passenger and express business was taken by one line and freight by the others. The contract between the German lines and the Morgan syndicate made provision for the sharing by the two interests of new trade, or of extension when the enlargement amounted to doubling the number of sailings.

3. Pooling of profits seems to be quite common, if one may infer from the known number of these ordinarily secret arrangements. The two great German companies appear to have a money pool, and it is announced from time to time in the press that they have pools with some of the smaller German companies. There is a pool of passenger earnings between the two German companies, the Holland-American and the Red Star Line, which belongs to the International Merchant Marine Company, and runs to Antwerp. The German East-Africa Company and the Austrian Lloyd got into competition because the Austrian line entered the East Africa trade, but after various negotiations† they announced a reported agreement by which "receipts from the passenger branches of the two services shall be divided at fixed intervals between the two companies, and that a mutual understanding shall also be arranged as regards the goods traffic."

The pooling of profits in ocean-carrying is comparatively simple if office expenses are left out, as is usually the case. The ships are often chartered, the owner furnishing the crew, so that the expense account, as well as income, can be calculated to a nicety. Even where ships are not chartered, it is common to have them surveyed when they enter pool service, and the owner credited with the same amount of money that he would have received if he had chartered the vessel to outside parties at current rates.

There is a profit pool among the carriers from the United Kingdom to Australia. Within the past decade there have been profit pools in the line trade from New York to Australia and from New York to Brazil, and there was every outward sign that there was also one from New York to South Africa. Its existence was finally revealed in May, 1905, by a suit in the court of King's Bench, London.‡ Three British firms in the United Kingdom-South African

\*The Hamburg-American and North German Lloyd companies were formed by such groups of merchants who desired a better service than their occasional independent ships gave, and, uniting, formed the now famous companies.

†Fairplay, January 28, 1904, p. 145.

‡See New York Journal of Commerce, June 7, 1905.



trade also had vessels in New York service. They were entitled to 21 per cent. in the pool; the German Hansa line had 16 per cent., and was sued because of the failure to maintain the agreement which was entered into October 23, 1901. During most of this period there was a rate war in progress, and the difficulty of operating a pool under these circumstances is shown by the fact that in 1902 there were 87 meetings and in 1903, 61.

Pools of both sorts are apt to be short-lived, as were most of those referred to above, because of their tendency to become non-progressive arrangements. They heal the difficulty of the hour, but they must be well arranged, indeed, if they can provide for the satisfactory division of increased trade among the participants. This is the rock upon which they all alike go to pieces. It matters little whether they be divisions of traffic or divisions of money. One line feels that its position, expenditures, or activity merit a large share of the increase in the trade. The line that has done less wants, of course, an equal share. An example will illustrate: In February, 1893, the British-India, Peninsular & Oriental, and Hansa steamship companies came to a clear-cut agreement about the trade between Middlesboro', London, Hamburg and Antwerp with India. In September, 1898, it was modified, apparently in favor of the stronger parties, so that if Antwerp freight exceeded the capacity of the Hansa steamers, each of the other lines could have six sailings a year from Antwerp, the amount of freight in each of these additional sailings being prescribed and limited. This lasted until January, 1905, when the P. & O. Company, again dissatisfied, threw the agreement to the winds, announced more frequent sailings from Antwerp, and a long rate war between the two British companies and the German company followed. Announcement of its end in the spring of 1907 did not give the terms of the agreement.

4. Shipping conferences. These are usually agreements to maintain rates upon a certain route. Once the carriers have agreed, they usually arrange a schedule of sailings, rendering the best possible service, and keep off competitors by a system of deferred rebates. This is usually 10 per cent. of the freight. It is calculated at the end of a long period, usually six months, and paid six months or a year later, *provided* the shipper has remained "loyal" to the members of the conference. Shipping by a rival line is, of course, "disloyalty," so that the conference carriers, by means of these deferred rebates, practically keep all regular shippers under bonds to let all rivals severely alone. Thus is the shipper bound. The starting of rival shipping lines is deterred by the certainty of fierce competition, and by the restraining tendency which the rebates will have on the people who would otherwise ship by the new line.

Despite this inner stay and outer prop, the way of the shipping conference is far from smooth. The prosperity that attends their success attracts the hungry outside shipowner who sets up competition, creates chaos and general loss in the hope of being admitted to the conference.

Owing to the oft and widely repeated fact that the United States has had few and poor shipping connections other than trans-Atlantic, the best place to see the shipping conference in full operation is in European trade, where the steamship lines are older and well established. The best single example is the South African Shipping Conference, which has successfully regulated the trade of a region that stood for some years in the glare of the world's attention. It is also an unprosperous region where discontent is rife and where there is diligent search for the causes of this lack of prosperity which leads to discontent. The fact that the conference has had long success and consequent freedom from rivals has produced a feeling of independence and made it less anxious to please the shipper in matters of detail. All these influences have combined to throw much light on the South African Shipping Conference.

A New York freight broker, well acquainted with European conditions, recently declared: "The steamship people in England ride the shippers; they *ride* them; they say 'you can have so much space in such and such a ship.' The British shippers seem to be of the same opinion. After the close of the Boer War the press was full of complaining letters. Such grave bodies as the Liverpool and Leeds Chambers of Commerce took the matter up and condemned it vigorously; the colonial premiers entered into correspondence with the head of the conference; and South African commercial bodies were quite as active as those of England.

The Leeds Chamber of Commerce showed that when a rival line had arisen and the rebates had failed to hold the shipper, the conference had quoted double (prohibitive) rates when the shipper persisted in patronizing the new company for that part of the freight which the new carrier could place. The British public was also enraged because the rates to Africa were from 24s. to 80s. per ton, and the same firms had steamers in the New York-South African service and were giving rates from New York at 10s. to 20s.\*

American trade was naturally booming at the expense of the English. To this criticism the carriers replied that the New York rate was a heavy loss owing to competition, and that the rates from all continental points were the same as from British ports, a point

that had been carefully stipulated in all arrangements with German and other lines.

From South Africa also came the charge of excessive rates, but the carriers declared their rates were reasonable, and that the African importers were suffering from the exactions of the colonial railroads. In this connection a paper before the Institute of Civil Engineers shows that on the basis of 1.54d. per ton per geographical mile for mineral trains in England, the total sea-borne rate was about one thirty-fifth of that figure. At the time of the African complaint against the shipping "ring," the rate on iron from the United Kingdom to Kimberley was as follows:

| Distance     | Via Cape Town |        | Via Port Elizabeth |        | Via Durban |             |
|--------------|---------------|--------|--------------------|--------|------------|-------------|
|              | Rail.         | Ocean. | Rail.              | Ocean. | Rail.      | Ocean.      |
| Rate per ton | 647           | 6,181  | 485                | 6,609  | 483        | Circ. 7,000 |
|              | 218/5         | 22/6   | 166/2              | 22/6   | 110/-      | 25/-        |

Various persons and chambers of commerce were appealing to the British government to give them relief of some sort and one proposal was to give the mail and government contracts to an independent line that should be formed. An editorial in *Lloyd's Gazette* in August, 1904, stated that while monopoly had made the conference carriers a little autocratic in their manners, any government scheme to start another line "would just make it strong enough to join the conference." Occasionally, Sir Donald Currie, head of the largest British interests in the conference, would reply to the numerous attacks. One such long letter\* made the challenging statement that "the South African trade is quite open." But owing to the rebate control and boycott rates it was practically open only to a line or combination that could offer as good a service, and that, as experience proved, was a heroic task. It is common for steamers to South Africa to skirt the coast, stopping at three or more ports. When competition did spring up, the conference lines eclipsed it by despatching a vessel directly to each of the three main ports, and it is currently reported that one of the lines in the conference got in only after losing a million dollars in a rate war which finally brought the conference to terms. So the statement that the trade "is quite open" may have needed a little interpretation.

In a letter to Mr. Chamberlain, Sir Donald Currie said (see *New York Journal of Commerce*, June 18, 1903): "This so-called rebate system prevails in every ocean steam trade, and while providing the necessary support which steamers, to be regularly employed, regularly require, it secures under suitable arrangements with the merchants regularity of rates, as well as the supply of sufficient steam tonnage."† *Fairplay* quoted Mr. Birchenough (who had been sent to South Africa by the government to investigate the matter) as saying: "The rebate system prevents the cutting of rates, and it is to that extent as much a protection to the shippers as to the 'ring';" and the journal then stated editorially that, "as a simple matter of fact, the present very efficient service to the Cape could not possibly be worked otherwise than by a conference agreement."

The discussion of this rebate problem steadily continued, rose almost to the degree of ferment, and would not down. Finally, after special reports had been made to the British government upon it, a royal commission was appointed, in November, 1906, to inquire "into the operations of shipping rings or conferences generally, and more especially into the system of deferred rebates, and report whether such operations have ceased or are likely to cause injury to British or Colonial trade, and if so, what remedial action, if any, should be taken by legislation or otherwise."

The rather full accounts of hearings which were reported from time to time in *Lloyd's Gazette* and other maritime journals furnished much detailed information concerning the actual situation.

The disadvantages of the rebate system have been clearly pointed out. The Secretary of the Birmingham Chamber of Commerce testified that merchants have been so penalized that they were afraid to testify. The penalties have been doubled rates or no service. A representative of the London Chamber of Commerce testified that the heavier shippers got special secret rebates. But the most galling piece of testimony seems to have been the fact that the shipping ring lines charged higher rates from British ports than they did upon the same ships for continental or American goods going out to the British colonies and foreign lands. For example, the China Conference was inveighed against because the American rate was 25 shillings, and the London rate 45 shillings to China; and an offer of a 20 shilling rate from London, the British shipper dare not take, and kept on paying his 45 shillings, because he was tied with a heavy rebate shackle. Complaint was made that the British glassware paid 37 shillings and a half to New Zealand, while the same steamer took Continental glassware from Antwerp and Hamburg on a through rate at 22 shillings and a half. The defense of this on the part of the shipping company was that only by this means could they meet the competition of Continental steamers.

In answer to the direct question by the Commissioners, "Do you recommend the abolition of rebates by statute?" there was a surprising temperance of answer on the part of the aggrieved merchants; almost none of them favored such action. In the first place, it was pointed out that the attempted prohibition by the United States

\*This type of grievance still remains and is embodied in a strong resolution of the Associated Chambers of Commerce of Great Britain which met in London, March 7, 8, 1906.

\**Syren and Shipping*, June 24, 1904.  
†*Fairplay*, September 22, 1904, p. 444.

government while it had caused a temporary cessation of rebates, was really ineffective; because the rebate could be worked by a foreign corporation through its foreign offices.

The suggestion of the legal prohibition of rebates brought out a rather surprising statement of their advantages. It was shown that they permitted regularity and uniformity of rates, which enabled the merchant to make quotations for long times in the future; and, lastly, the shipping companies usually bound themselves to stop competing with the merchants by so-called "filling lines." This common practice has long been resorted to by shipping lines. When freight was dull, they would fill their ships with goods on their own account, to be sold in competition with merchants who were their patrons. Escape from this the merchants deemed a great gain.

A representative of the Ceylon Association of London testified that he thought the one year deferred rebate was too long a time for the money to be held by the carrier, and was therefore not liked by the shippers; but they didn't wish anything to interfere with the splendid, almost daily, service which the Ceylon shippers enjoyed by the 120 first class steamers which were returning from that island to European markets. Therefore, on the whole, they were against any legislation on rebates, for fear that the shipping lines might make something that bore more heavily upon them, since "a reasonable and regular rate seems to us more beneficial to the shipper and trader than one subject to violent fluctuations."

The consensus of opinion of the witnesses was similar to that of the Ceylon tea shippers; but great insistence was placed on the fact that something should be done to prevent lines carrying foreign goods more cheaply than British goods to the detriment of British trade. In this respect the conference of West Africa was held up as a shining example. The two British lines controlled by Elder, Demster & Company had an agreement with the one rival German line, which they dominated, and as its result they had built up a splendid service, and to prevent the founding of a line directly with America, a rate was given to America, via Liverpool, which was identical with the rate to Liverpool only.

The China Conference is one of long standing, and, like numerous others from Europe outward, it has succeeded in keeping less before the public. One of the largest of these combinations is the reported agreement between two groups of west coast South American carriers—the Panama group, comprising eight companies, and the Magellan group of four companies. In the Panama group were companies representing America, England, Germany, France and Italy.

The founding of lines of steamers from New York to other than European and West Indian ports has had its largest and almost its entire development since 1890, and while these lines have not been long established, they have compassed practically all of the experiences in the catalogue of agreements among carriers. To South America, Africa, Australia and the east there were sailing-vessel lines that had grown up gradually from the operations of exporting merchants. This commerce has grown great enough to tempt the old-established firms of British shipowners to establish employment for some of their vessels by putting them into steam services from New York to the various coasts above mentioned. This was a direct blow at the trade of the American firms that had handled the trade from its inception, and strong rivalries have ensued. This has been further complicated by the coming of the German steamers upon the scene. Peculiar incidents have occurred in these contests. Firms agreeing in European conferences have competed here; at least one New York firm has been in both the east South American trade and the South African trade, but in one it fiercely competed with firms with which it had agreements in the other trade. The New York carrying combinations are well typified in all important respects by the happenings in the Australian trade.

The first of line service was in 1853, when two firms began taking turns in sending out their sailing vessels. In 1878 a Boston firm began, and in 1884 added a New York service, taking turns with the other two companies, and each got what rates it could at the agreed-upon time of sailing. In 1889 a fourth company essayed to enter this service and it was admitted, after a year of rate cutting, during which rates fell from 27½ cents per cubic foot to 7 cents.

The four companies now agreed and conducted their business without serious disturbances until 1896 and 1897, when some outside merchants chartered, loaded and despatched some ships to an Australian firm. This promised easily to become the origin of another line. Shortly thereafter the four carriers made rebate contracts, promising a 10 per cent. rebate if shipments were not sent by any outside line. The agreement was made with many firms, some for five years and others for shorter periods, down to one year and less. The shorter periods were apparently accepted because of the probability of opposition. At this time the charge was freely made that the four firms, by combining the functions of commission merchants and carriers, used their carrying functions to benefit their business as merchants to the detriment of other merchants. This very natural desire could be effected, as was then charged, by quoting rival commission houses higher rates, and by so-called "filling-orders"—filling up a ship, when cargo was scarce, with "bulk lines" to be sold in Australia in competition with their patrons who had paid full rates of freight.

In the spring of 1898 two London shipping firms, desiring return cargoes for ships carrying Australasian frozen meat to the United Kingdom, sent their steamers to New York to load outward. The four New York firms, which had been sending sailing vessels only, united in organizing the United States and Australasian Steamship Company, and placed at its head a man from one of their offices. This was done the very day that the advertisement of the British steamship service appeared, and the Americans succeeded in despatching the first steamer. The war was carried into the enemy's country by sending steamers to South Africa where the competing English firms had important services. This was a new venture for the Australasian shippers and was purely an incident of the lively war that raged from May until December, 1898. Rates were put down to 10s. a ton, about the cost of stevedoring and dunnage wood, and in December there was an agreement between the New York firms and the two London firms, but a third London line which had entered during the competition did not enter as a part of the agreement that formed the so-called Associated Line.

Before the beginning of the competition each of the four firms had taken its turn on the berth and had made what profits it could from its ship. The Associated Line worked on a profit pool said to have been divided equally between the New York and London interests. It, of course, had the rebate arrangement and the carriers promised to do away with the obnoxious "filling lines." This Anglo-American agreement seems never to have run smoothly. Even the public press frequently mentioned the fact. Old-established American firms, accustomed to making their decisions on the spot, were dealing with the agents of British shipowners who are notorious for deciding in London everything for their agents in New York, whether they know the conditions in New York or not. That they do not know the New York situation is the consensus of American-New York opinion. In addition to internal troubles, the Associated Line had the strong competition of the one outside firm which was not well controlled by the rebates. Stronger measures were tried. In May, 1899, an Associated Line circular stated that if, after the first day of July, any commission house should consent to fill a buying order for any Australian or New Zealand merchant who insisted upon shipping by any line but the Associated Line, that commission house will not only lose its 10 per cent. deferred rebate for that client, but will in addition have to pay an additional rate of 5s. per ton upon all freight shipped to Australia, and 7s. 6d. per ton extra to New Zealand. This embraced all business done by the New York commission firm for clients "loyal" and "disloyal" to the Associated Line. The rival line continued to prosper, and in April, 1900, the penalties were increased to 12s. 6d. per ton, "on condition that they buy their goods from a loyal supplier, the consignee's name being subject to approval of one of the members of the Associated Line."

The attempts at coercion failed, and within a month the Associated Line had ceased to exist. It was resolved into its original elements, and rebates and penalties were declared off. During the exigencies of the fight it appears by the protests of merchants in both New York and Australia, that the rebates were withheld when due, and certainly were not paid for some months thereafter.\* This was merely one more effort to hold trade away from the rival. The end of the combination was brought about quite as much by internal trouble as by competition, as is evidenced by the fact that the breakup of the combination caused no immediate break in rates.

Since the end of the pool in May, 1900, there has been a continuation of the ups and downs in the trade until the mere mention of the Australian trade makes a New York shipping man refer to primeval chaos. The steamship company owned by the four united New York companies is sending out both steamships and sailing vessels, and the three British firms are still in the business. In September, 1901, rate cutting apparently took the form of seeing who had the most money to lose. Weight cargo was carried for 5s. to 7s. 6d. per ton, and measurement cargo for 10s. The American company seems to have outgeneraled its opponent in this contest of loss. The shipping journals show that they advertised the same steamer from December 2 until March 27, when she finally sailed. In the interval she was making short voyages in nearby waters. The earlier cargoes that she should have taken to Australia got sent on the rivals' ship at the rivals' heavy loss. In May, 1902, there appears to have been an oral agreement that lasted till October, 1904, when one of the British lines started in to get a better share of the freight. This war lasted until August, 1905, after which time the carriers lived along for some months on day-to-day rate understandings, and efforts to pool the traffic or proceeds came to naught because the different parties could not see alike with regard to respective proportions that each should have. In February, 1906, one of the London companies suddenly made a great increase in the tonnage of its service. To secure freight for it, concessions in rates were made to some shippers on some classes of goods, but this had not resulted in a general disturbance of rates on April 8. This situation, like many another in the commercial world, is materially affected by bitter personal animosities existing

\*New York Journal of Commerce, April 21, 1901.



between some of the principals, and rendering them oblivious to the ordinary economic impulses.

This detailed account of the recent developments in the New York-Australian trade, with its freight and money pools, its competitions, rebates and virtual boycotts, differs but little from the history of the trade to South Africa or East South America. In all of them the old American exporting firms have had to meet the competition of European shipowners who have competed by setting up new steamship lines. In the struggles that have followed, the pool, the rebate, and the boycott have been freely used. The boycott has not frankly borne that name, but the same practical result has been attained by indirect means. One method is the prohibitive rate described in the account of the Australian trade. A common device of the agent for the foreign-owned ship is the "inability" to name a rate. "I'll have to cable to headquarters," replies the agent. Upon application the next day or the next, the cable "hasn't come yet." Another method of achieving this result is for the ship's agent to tell the applicant that he has no space, although the next applicant, if friendly, may contract for 500 tons. In a recent conversation a New York freight broker said that he was boycotted by the carriers to four different parts of the world. It should be noted that it is the broker who is usually boycotted, not the actual consignor of the freight. He can get another broker and have his bargain made.

There is one broad difference between the recent American and British shipping conferences. Those in Europe are made by lines owning ships that they use. The American conferences have been upon the basis of hired ships or European ships being managed at long range by non-resident owners. The members of European conferences have therefore had more at stake, and in the freight depression prevailing since the Boer War most of the American conferences have gone to pieces from time to time, and most of the European conferences have survived.

One of the most successful of the American conferences is that of the four lines from New York to the Orient. Since the last peace in 1904 it seems to be getting stronger and displaying its strength day by day, until in July, 1907, it was declared by one shipper to exceed even the Hamburg-American in its independence. This appears to be strong language, as a later article will show.

The rebate system is comparatively new in the New York trades and seems to have had its chief growth since the coming of the British steamers to compete with the American sailing vessel merchant-carrier firms. The recent strenuous competition between carriers from New York to South Africa led to the withholding of rebates because of "disloyalty." The dissatisfaction of some of the penalized firms over the definitions of loyalty led to a suit being brought against the carriers in New York in 1904, and it is currently stated that a letter from the United States Attorney General's office so alarmed the foreign owners that they feared to risk trial under the Sherman law, and stopped all rebates for a time. The foreign shipping representatives are reported to have said that they would carry our freight for us, but they did not care to go to prison for us. There was shortly afterward a change in the head of the United States Department of Justice, and the rebates began again in some quarters. The suit did not come to trial.

(To be continued.)

#### New Rails for the Canadian Pacific.

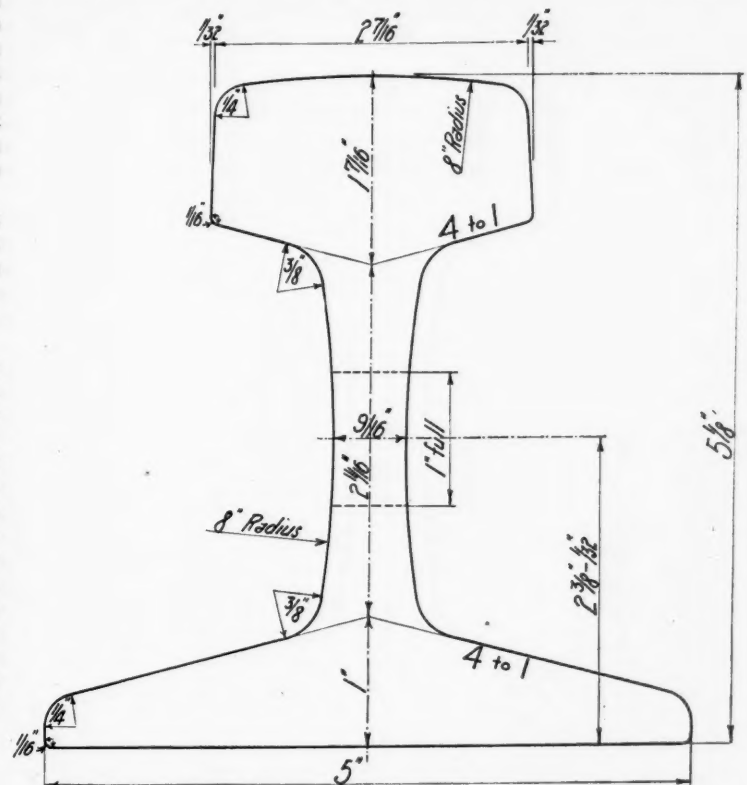
The Canadian Pacific recently ordered 40,000 tons of 85-lb. Bessemer and open hearth rails from the Dominion Iron & Steel Co., and the Algoma Steel Co. A new section has been adopted for these rails, in place of the A. S. C. E. section which the road has heretofore used. As may be seen from the accompanying drawing, this section is in general similar to the series A section recommended in the October, 1907, report of the American Railway Association's Committee on Standard Rail and Wheel Sections. Still more metal, however, has been taken from the head and added to the base, while the web has been reinforced. The head, though smaller, is shaped much like that of series A, except that the sides are more nearly vertical. The radius of the upper corners is  $\frac{1}{4}$  in. instead of  $\frac{3}{8}$  in., and the radius of the top of the head is 8 in. instead of 14 in. The minimum thickness of the web is about the same, but it is reinforced at the top and bottom, the radius of the sides of the web being 8 in. instead of 14 in. The base is somewhat deeper and is distinctly wider, being only  $\frac{1}{2}$  in. narrower than the rail is high, as it is believed that, although the road uses tie plates on all curves, it cannot sacrifice the added safety which the wider base gives. The base is, however,  $\frac{1}{8}$  in. narrower than the A. S. C. E. section. The vertical moment of inertia is 29.492, and the horizontal, 7.139. Other figures are as follows:

|             | Area, per-<br>centages. | Cooling per-<br>centages. | Section modulus |             |
|-------------|-------------------------|---------------------------|-----------------|-------------|
|             |                         |                           | Vertical.       | Horizontal. |
| Head .....  | 36.77                   | 1.965                     | 10.425          | .....       |
| Web .....   | 22.21                   | 3.081                     | .....           | .....       |
| Base .....  | 41.02                   | 2.875                     | 12.84           | 2.855       |
| Total ..... | 100.00.                 | 2.586                     | .....           | .....       |

The specifications for the manufacture of these rails follow the

general principles laid down in the proposed and standard specifications of the American Railway Association, the Maintenance of Way Association, and the American Society for Testing Materials. There are several interesting differences. The carbon content in the Bessemer rail is the same as the A. S. C. E. and M. of W. specifications so far as the limiting percentage, but it is further required that it average between 0.57 and 0.59. The percentages of phosphorus and sulphur are the same as the A. S. C. E. and M. of W., but the limits of manganese are 0.80 and 1.00 instead of 0.80 and 1.05. The percentage of silicon is not to exceed 0.18 per cent.; the A. S. C. E. and M. of W. limit is 0.20. For the open hearth rail, the limits for carbon are 0.56 and 0.66 with an average of not less than 0.60. The A. S. C. E. limits are 0.58 and 0.68, and the M. of W. 0.68 and 0.78. The limit of phosphorus is 0.06, the A. S. C. E. limit being 0.05 and the M. of W., 0.03. Sulphur is not to exceed 0.055; the two societies make this 0.06. The limits for silicon are 0.075 and 0.018. The M. of W. limits are 0.075 and 0.020, while the A. S. C. E. gives only a maximum of 0.20. The manganese limits are 0.80 and 1.00; the A. S. C. E. are 0.80 and 1.05, and the M. of W. maximum is 0.90. An addition to the usual list of percentages is the requirement that the sum of sulphur plus copper plus other injurious elements be not more than 0.075.

In the branding specifications, aside from the requirements made by the three societies as to weight, name of maker, date of manu-



facture and heat number, it is specified that the part of the ingot from which the rail is rolled be also indicated.

After cutting off or allowing for the "sand" or top end of each ingot, at least 12 in. more of seemingly hot steel shall be cut off that end of the bloom; if the steel does not then appear solid, the cutting shall continue until it does. No bled ingots or ingots from chilled heats, or from badly poured heats shall be used.

The drop tests of Bessemer rails are not quite as severe as the A. S. C. E. and M. of W. requirements. A section of rail is to be tested from every third heat, and the weight is to fall 18 ft. instead of 20 ft. It is, however, provided that should a heat be rejected, similar tests shall be made of rails from the preceding and succeeding heats. For open hearth rails, three sections of rail taken from the top of the first, middle and last ingots of each 50 ton heat are to be tested. The heat is to be rejected unless two of the tests stand.

From reports made to the company by its inspectors, it seems that the new rail requires less cold straightening and less camber; also, as is to be expected, the temperature is more uniform throughout the rail after leaving the rolls than in the old A. S. C. E. section.

#### Block Signals on the Railroads of the United States, Jan. 1, 1908.

The tables which appear on the following pages have just been issued by the Interstate Commerce Commission. Table 1 is an exhibit showing for each reporting company the aggregate length of its lines or parts of lines on which the block system is in use; Table 2 shows the kinds of automatic signals used; Table 3 is an exhibit of the methods and apparatus used in the operation of the

TABLE 1.—AGGREGATE LENGTH OF LINES OR PARTS OF LINES ON WHICH THE BLOCK SYSTEM IS IN USE JANUARY 1, 1908.

| Names of railroads.   | Automatic block signals. |               |              |             |         | Nonautomatic block signals. |               |              |             |         | Total, all kinds. | Total miles operated by company (passenger lines). | Per cent operated under block system. |
|---|--------------------------|---------------|--------------|-------------|---------|-----------------------------|---------------|--------------|-------------|---------|-------------------|--|---------------------------------------|
|   | Single track.            | Double track. | Three track. | Four track. | Total.  | Single track.               | Double track. | Three track. | Four track. | Total.  |                   |  |                                       |
| Ann Arbor.....  |                          |               |              |             |         | 1.0                         |               |              |             | 1.0     | 1.0               | 292.0  | 100.0                                 |
| Atchison & Eastern Bridge.....  |                          |               |              |             |         | .4                          |               |              |             | .4      | .4                | 19.9   | 19.9                                  |
| Atchison, Topeka & Santa Fe.....  |                          | 20.2          |              |             | 20.2    | 1,144.3                     | 327.5         |              |             | 1,471.8 | 1,492.0           | 7,480.3  | 14.5                                  |
| Atlanta & West Point.....   |                          |               |              |             |         | 6.0                         |               |              |             | 6.0     | 6.0               | 4,181.0  | 14.1                                  |
| Atlantic Coast Line.....  |                          |               |              |             |         | 527.0                       | 62.4          |              |             | 589.4   | 589.4             | 2,964.5  | 35.6                                  |
| Baltimore & Ohio.....   | 11.2                     | 131.6         |              |             | 142.8   | 222.9                       | 600.3         | 70.3         | 18.5        | 912.0   | 1,054.8           | 981.0  | 6.0                                   |
| Baltimore & Ohio Southwestern.....  |                          |               |              |             |         | 8.7                         | 48.5          |              | 2.2         | 59.4    | 59.4              | 4.7  | 63.5                                  |
| Baltimore & Sparrow's Point.....  |                          |               |              |             |         |                             | 3.0           |              |             | 3.0     | 3.0               | 216.0  | 86.2                                  |
| Bessemer & Lake Erie.....   |                          |               |              |             |         | 101.2                       | 84.9          |              |             | 186.1   | 186.1             | 2,238.6  | 13.0                                  |
| Boston & Maine.....   | 3.1                      | 172.8         | 0.5          | 2.1         | 178.5   |                             | 123.6         |              |             | 302.1   | 302.1             | 421.9  | 100.0                                 |
| Buffalo, Rochester & Pittsburgh.....                                      |                          |               |              |             |         | 308.6                       | 113.3         |              |             | 421.9   | 421.9             | 23.5   | 10.2                                  |
| Caldwell & Northern.....  |                          |               |              |             |         | 2.4                         |               |              |             | 2.4     | 2.4               | 30.0   | 53.3                                  |
| Camden Interstate.....  |                          |               |              |             |         | 16.0                        |               |              |             | 16.0    | 16.0              | 65.1   | 3.4                                   |
| Central of Georgia.....   |                          |               |              |             |         | 50.1                        | 15.0          |              |             | 65.1    | 65.1              | 212.4  | 47.8                                  |
| Central of New Jersey.....  | 13.0                     | 169.0         |              | 30.4        | 212.4   |                             |               |              |             |         |                   | 1.5  | 403.3                                 |
| Central Vermont.....  |                          |               |              |             |         | 1.5                         |               |              |             | 1.5     | 1.5               | 1,670.7  | 88.8                                  |
| Chesapeake & Ohio.....  |                          |               |              |             |         | 1,194.8                     | 288.2         |              |             | 1,483.0 | 1,483.0           | 700.7  | 77.5                                  |
| Chicago & Alton.....  | 170.3                    | 141.1         |              |             | 311.4   | 351.4                       | 37.9          |              |             | 389.3   | 389.3             | 693.0  | 49.5                                  |
| Chicago & Eastern Illinois.....   | 3.6                      | 103.5         |              |             | 107.1   | 169.4                       | 57.5          |              |             | 226.9   | 226.9             | 3,189.5  | 41.4                                  |
| Chicago & Northwestern.....   |                          | 591.2         | 12.5         | 2.4         | 606.1   | 2,354.9                     | 228.5         |              |             | 2,583.4 | 2,583.4           | 8,968.2  | 98.7                                  |
| Chicago & Western Indiana.....  |                          | 7.5           |              |             | 7.5     |                             | 19.8          |              |             | 19.8    | 19.8              | 27.3   | 100.0                                 |
| Chicago, Burlington & Quincy.....   |                          | 30.8          |              | 5.5         | 36.3    | 8,289.1                     | 503.3         | 18.7         | 1.4         | 8,812.5 | 8,812.5           | 735.0  | 40.7                                  |
| Chicago Great Western.....  |                          | 7.9           |              |             | 7.9     | 264.2                       | 26.8          |              |             | 291.0   | 291.0             | 6,596.9  | 70.2                                  |
| Chicago, Milwaukee & St. Paul.....  | 5.9                      | 38.0          |              |             | 43.9    | 4,167.6                     | 385.4         |              |             | 4,553.0 | 4,553.0           | 6,679.8  | 15.3                                  |
| Chicago, Rock Island & Pacific.....                                       | 1.0                      | 152.1         |              |             | 153.1   | 752.0                       | 118.6         |              |             | 870.6   | 1,023.7           | 1,486.5  | 44.5                                  |
| Chicago, St. Paul, Minneapolis & Omaha.....                               |                          | 6.4           |              |             | 6.4     | 591.6                       | 64.1          |              |             | 655.7   | 655.7             | 46.1   | 11.7                                  |
| Chicago Terminal Transfer.....  |                          | 5.4           |              |             | 5.4     |                             |               |              |             |         |                   | 11.4   | 7.7                                   |
| Cincinnati & Muskingum Valley.....  |                          |               |              |             |         | 11.4                        |               |              |             | 11.4    | 11.4              | 148.4  | 11.0                                  |
| Cincinnati, Hamilton & Dayton.....  |                          |               |              |             |         | 73.0                        | 27.9          |              |             | 100.9   | 100.9             | 177.4  | 10.7                                  |
| Cleveland, Akron & Columbus.....  |                          |               |              |             |         | 11.0                        | 8.0           |              |             | 19.0    | 19.0              | 22.0   | 100.0                                 |
| Cornwall & Lebanon.....   |                          |               |              |             |         | 8.3                         | 13.7          |              |             | 22.0    | 22.0              | 31.3   | 23.3                                  |
| Cumberland & Pennsylvania.....  |                          |               |              |             |         | 4.3                         |               | 3.0          |             | 7.3     | 7.3               | 163.2  | 17.7                                  |
| Cumberland Valley.....  |                          |               |              |             |         | 18.8                        | 10.1          |              |             | 28.9    | 28.9              | 41.7   | 100.0                                 |
| Davenport, Rock Island & Northwestern.....                                |                          |               |              |             |         | 40.6                        | 1.1           |              |             | 41.7    | 41.7              | 743.9  | 54.8                                  |
| Delaware & Hudson.....  | 177.2                    | 208.6         | 4.3          | 17.5        | 407.6   |                             |               |              |             |         |                   | 466.5  | 54.3                                  |
| Delaware, Lackawanna & Western.....                                       | 1.4                      | 459.0         | 6.1          | 13.6        | 470.1   | 643.5                       | 623.9         |              |             | 1,267.4 | 1,341.0           | 1,744.6  | 77.0                                  |
| Erie.....   |                          | 60.0          |              |             | 60.0    | 240.4                       | 8.4           |              |             | 248.8   | 248.8             | 51.8   | 70.0                                  |
| Chicago & Erie.....   |                          |               |              |             |         | 26.1                        |               |              |             | 26.1    | 26.1              | 236.1  | 8.0                                   |
| New Jersey & New York.....  |                          | 10.5          |              |             | 10.5    |                             |               | 20.7         |             | 20.7    | 20.7              | 436.5  | 0.5                                   |
| New York, Susquehanna & Western and Wilkesbarre & Eastern.....            |                          |               |              |             |         |                             |               | 2.2          |             | 2.2     | 2.2               | 236.1  | 8.0                                   |
| Grand Rapids & Indiana.....   |                          |               |              |             |         |                             |               |              |             |         |                   | 436.5  | 0.5                                   |
| Grand Trunk Railway System:   |                          |               |              |             |         |                             |               |              |             |         |                   |  |                                       |
| International boundary to Black Rock Jet.....                             |                          |               |              |             |         | 0.7                         |               |              |             | 0.7     | 0.7               | 0.7  | 100.0                                 |
| Atlantic & St. Lawrence.....  |                          |               |              |             |         | 165.1                       |               |              |             | 165.1   | 165.1             | 330.9  | 100.0                                 |
| Grand Trunk Western.....  |                          |               |              |             |         | 7.0                         | 323.9         |              |             | 330.9   | 330.9             | 105.6  | 100.0                                 |
| Michigan Air Line.....  |                          |               |              |             |         | 105.6                       |               |              |             | 105.6   | 105.6             | 189.0  | 100.0                                 |
| Detroit, Grand Haven & Milwaukee.....                                     |                          |               |              |             |         | 185.5                       | 3.5           |              |             | 189.0   | 189.0             | 57.4   | 100.0                                 |
| Chicago, Detroit & Canada Grand Trunk Junction.....                       |                          |               |              |             |         | 54.7                        | 2.7           |              |             | 57.4    | 57.4              | 2.0  | 100.0                                 |
| St. Clair Tunnel.....   | 2.0                      |               |              |             | 2.0     |                             |               |              |             |         |                   | 1.5  | 100.0                                 |
| Grand Rapids Terminal.....  |                          |               |              |             |         | 1.1                         | 0.4           |              |             | 1.5     | 1.5               | 6,168.0  | 5.2                                   |
| Great Northern.....   | 6.2                      | 62.0          |              |             | 68.2    | 252.1                       |               |              |             | 252.1   | 252.1             | 74.7   | 22.1                                  |
| Hocking Valley.....   |                          |               |              |             |         | 74.7                        |               |              |             | 74.7    | 74.7              | 5,598.1  | 18.8                                  |
| Illinois Central.....   | 28.0                     | 227.9         |              | 12.0        | 267.9   | 783.9                       |               |              |             | 783.9   | 1,051.8           | 394.4  | 7.0                                   |
| Iowa Central.....   |                          |               |              |             |         | 27.8                        |               |              |             | 27.8    | 27.8              | 20.0   | 53.0                                  |
| Kentucky & Indiana Bridge & Railroad Co. Lackawanna & Wyoming Valley..... |                          |               |              |             |         | 7.2                         | 2.7           | 0.7          |             | 10.6    | 10.6              | 22.6   | 15.0                                  |
| Lehigh Valley.....  | 14.1                     | 411.0         | 34.6         | 10.8        | 470.5   | 1.0                         | 2.4           |              |             | 3.4     | 3.4               | 1,141.9  | 100.0                                 |
| Long Island.....  | 4.0                      | 65.2          |              | 3.7         | 72.9    | 635.6                       | 54.8          |              |             | 750.4   | 750.4             | 392.0  | 24.4                                  |
| Louisville & Nashville.....   | 7.0                      |               |              |             | 7.0     | 445.5                       | 38.8          |              |             | 484.3   | 491.3             | 3,775.0  | 13.0                                  |
| Maine Central.....  | 62.3                     | 29.2          |              |             | 91.5    |                             |               |              |             |         | 91.5              | 910.6  | 10.1                                  |
| Missouri Pacific.....   | 126.0                    | 23.9          |              |             | 149.9   | 226.6                       | 3.3           |              |             | 226.9   | 379.8             | 5,212.6  | 7.3                                   |
| Mobile & Ohio.....  |                          | 4.7           |              |             | 4.7     | 42.4                        |               |              |             | 42.4    | 47.1              | 825.0  | 9.6                                   |
| Monongahela.....  | 0.5                      |               |              |             | 0.5     |                             |               |              |             |         | 0.5               | 53.6   | 0.9                                   |
| Monongahela Connecting.....   |                          |               |              |             |         |                             | 4.0           |              |             | 4.0     | 4.0               | 55.0   | 8.0                                   |
| Nashville, Chattanooga & St. Louis.....                                   |                          |               |              |             |         | 89.8                        | 7.2           |              |             | 97.0    | 97.0              | 1,236.5  | 7.8                                   |
| New York & Long Branch.....   |                          | 38.0          |              |             | 38.0    |                             |               |              |             |         | 38.0              | 38.0   | 100.0                                 |
| New York Central Lines:   |                          |               |              |             |         |                             |               |              |             |         |                   |  |                                       |
| New York Central & Hudson River.....                                      |                          | 129.1         |              | 14.5        | 143.6   | 1,734.4                     | 604.7         | 43.3         | 305.6       | 2,688.0 | 2,831.6           | 2,843.5  | 99.5                                  |
| Boston & Albany.....  |                          | 152.0         |              | 19.2        | 171.2   |                             | 0.5           |              | 2.4         | 2.9     | 174.1             | 352.3  | 49.4                                  |
| Michigan Central.....   |                          | 272.0         |              |             | 272.0   | 984.4                       | 19.1          |              |             | 1,003.5 | 1,275.5           | 1,275.5  | 100.0                                 |
| Lake Shore & Michigan Southern.....                                       |                          | 311.8         | 67.8         | 120.0       | 499.6   | 950.3                       | 43.6          |              |             | 993.9   | 1,493.5           | 1,493.5  | 100.0                                 |
| Cleveland, Cincinnati, Chicago & St. Louis.....                           |                          |               |              |             |         | 582.8                       | 290.2         |              |             | 873.0   | 873.0             | 1,762.7  | 49.5                                  |
| Lake Erie & Western.....  |                          |               |              |             |         | 9.7                         | 8.9           |              |             | 18.6    | 18.6              | 827.0  | 2.3                                   |
| Pittsburgh & Lake Erie.....   |                          | 100.9         | 8.4          | 30.8        | 140.1   | 28.5                        | 2.9           |              |             | 31.4    | 171.5             | 190.7  | 90.0                                  |
| Chicago, Indiana & Southern.....  |                          | 2.0           |              |             | 2.0     | 16.7                        |               |              |             | 16.7    | 18.7              | 301.4  | 6.0                                   |
| New York, New Haven & Hartford.....                                       | 23.3                     | 228.3         |              |             | 251.6   | 395.0                       | 219.3         |              | 61.6        | 675.9   | 927.5             | 2,029.2  | 46.4                                  |
| New York, Ontario & Western.....  | 31.9                     | 102.9         |              |             | 134.8   |                             |               |              |             |         | 134.8             | 492.8  | 27.3                                  |
| Norfolk & Western.....  | 1.1                      | 29.3          |              |             | 30.4    | 1,506.7                     | 205.5         |              |             | 1,712.2 | 1,742.6           | 1,829.3  | 95.3                                  |
| Northern Pacific.....   | 3.9                      | 15.0          |              |             | 18.9    | 886.6                       | 224.9         |              |             | 1,111.5 | 1,130.4           | 4,975.5  | 22.7                                  |
| Pennsylvania Railroad.....  |                          | 46.7          | 2.9          | 187.8       | 237.4   | 1,084.4                     | 660.3         | 42.4         | 200.3       | 1,987.4 | 2,224.8           | 3,184.0  | 69.8                                  |
| Pennsylvania Company.....   | 17.8                     | 45.9          | 12.7         | 31.6        | 108.0   | 216.4                       | 521.9         | 10.8         | 11.4        | 760.5   | 868.5             | 1,305.4  | 66.5                                  |
| Pittsburgh, Cincinnati, Chicago & St. Louis.....                          |                          | 7.2           |              |             | 7.2     | 603.7                       | 416.8         | 49.2         | 19.9        | 1,089.6 | 1,096.8           | 1,408.5  | 77.8                                  |
| Philadelphia, Baltimore & Washington.....                                 |                          | 12.0          |              | 21.0        | 33.0    | 20.2                        | 155.3         | 20.4         | 11.3        | 207.2   | 240.2             | -646.7   | 37.1                                  |
| Northern Central.....   |                          |               |              |             |         | 287.2                       | 125.6         |              | 17.7        | 430.5   | 430.5             | 440.0  | 97.8                                  |
| West Jersey & Seashore.....   |                          | 85.2          | 6.0          |             | 91.2    | 51.6                        | 29.1          |              |             | 80.7    | 171.9             | 291.1  | 59.0                                  |
| Peoria & Pekin Union.....   |                          |               |              |             |         | 6.2                         | 6.5           |              |             | 12.7    | 12.7              | 16.7   | 76.0                                  |
| Pere Marquette.....   | 6.1                      |               |              |             | 6.1     | 29.3                        |               |              |             | 29.3    | 35.4              | 1,917.5  | 1.8                                   |
| Philadelphia & Reading.....   | 4.3                      | 282.8         | 40.5         | 15.8        | 343.4   | 98.2                        | 125.1         |              |             | 223.3   | 566.7             | 846.9  | 65.3                                  |
| Atlantic City.....  |                          | 86.7          |              |             | 86.7    | 23.5                        |               |              |             | 23.5    | 110.2             | 152.9  | 72.1                                  |
| Northeast Pennsylvania.....   | 2.9                      | 1.9           |              |             | 4.8     | 1.7                         |               |              |             | 1.7     | 6.5               | 25.9   | 25.1                                  |
| Perkiomen.....  |                          |               |              |             |         | 38.3                        |               |              |             | 38.3    | 38.3              | 38.3   | 100.0                                 |
| Philadelphia & Frankford.....   | 2.6                      |               |              |             | 2.6     |                             |               |              |             |         | 2.6               | 2.6  | 100.0                                 |
| Philadelphia, Newton & New York.....                                      | 4.2                      | 2.0           | 1.5          |             | 7.7     |                             |               |              |             |         | 7.7               | 22.2   | 34.7                                  |
| Reading & Columbia.....   |                          |               |              |             |         | 35.7                        |               |              |             | 35.7    | 35.7              | 53.3   | 67.0                                  |
| Queen & Crescent Route:   |                          |               |              |             |         |                             |               |              |             |         |                   |  |                                       |
| Alabama Great Southern.....   | 45.6                     |               |              |             | 45.6    |                             | 1.5           |              |             | 1.5     | 47.1              | 290.5  | 16.2                                  |
| Cincinnati, New Orleans & Texas Pacific.....                              | 272.1                    | 56.3          |              |             | 328.4   | 5.5                         |               |              |             | 5.5     | 333.9             | 335.9  | 99.4                                  |
| Richmond, Fredericksburg & Potomac.....                                   |                          |               |              |             |         | 9.8                         | 77.9          |              |             | 87.7    | 87.7              | 87.7   | 100.0                                 |
| St. Louis & San Francisco.....  | 25.0                     | 16.2          |              |             | 41.2    | 331.3                       | 16.5          |              |             | 347.8   | 389.0             | 4,767.2  | 8.1                                   |
| St. Louis Merchants Bridge Terminal.....                                  |                          | 5.7           |              |             | 5.7     |                             | 1.1           |              |             | 1.1     | 6.8               | 9.9  | 69.0                                  |
| San Pedro, Los Angeles & Salt Lake.....                                   | 1.1                      |               |              |             | 1.1     |                             |               |              |             |         | 1.1               | 1,066.4  | 1.1                                   |
| Seaboard Air Line.....  |                          |               |              |             |         | 210.1                       |               |              |             | 210.1   | 210.1             | 2,436.5  | 8.6                                   |
| Southern.....   |                          |               |              |             |         | 1,388.8                     | 205.2         |              |             | 1,594.0 | 1,594.0           | 5,920.6  | 26.9                                  |
| St. Louis-Louisville Lines.....   |                          |               |              |             |         | 148.6                       | 1.0           |              |             | 149.6   | 149.6             | 515.7  | 29.0                                  |
| Southern Illinois & Missouri Bridge.....                                  |                          | 4.6           |              |             | 4.6     |                             |               |              |             |         | 4.6               | 4.6  | 100.0                                 |
| Southern Pacific—Atlantic System:   |                          |               |              |             |         |                             |               |              |             |         |                   |  |                                       |
| Texas & New Orleans.....  | 106.7                    |               |              |             | 106.7   |                             |               |              |             |         | 106.7             | 438.7  | 24.3                                  |
| Louisiana Western.....  | 103.6                    |               |              |             | 103.6   |                             |               |              |             |         | 103.6             | 140.3  | 73.9                                  |
| Morgan's Louisiana & Texas.....   | 94.4                     |               |              |             | 94.4    |                             |               |              |             |         | 94.4              | 282.0  | 33.5                                  |
| Galveston, Harrisburg & San Antonio.....                                  | 39.5                     |               |              |             | 39.5    |                             |               |              |             |         | 39.5              | 1,275.5  | 3.1                                   |
| Southern Pacific—Pacific System.....                                      | 1,621.0                  | 131.0         |              | 1.0         | 1,753.0 | 102.3                       |               |              |             | 102.3   | 1,855.3           | 5,766.3  | 32.2                                  |



TABLE 1.—AGGREGATE LENGTH OF LINES OR PARTS OF LINES ON WHICH THE BLOCK SYSTEM IS IN USE JANUARY 1, 1908—Continued.

| Names of railroads,                             | Automatic block signals. |                |              |              |                 | Nonautomatic block signals. |                |              |              |                 | Total, all kinds. | Total miles operated by company (passenger lines). | Per cent operated under block system. |
|---|--------------------------|----------------|--------------|--------------|-----------------|-----------------------------|----------------|--------------|--------------|-----------------|-------------------|--|---------------------------------------|
|   | Single track.            | Double track.  | Three track. | Four track.  | Total.          | Single track.               | Double track.  | Three track. | Four track.  | Total.          |                   |  |                                       |
| Staten Island Rapid Transit.....                | 1.3                      | 7.0            |              |              | 8.3             | 8.9                         | 11.7           |              |              | 20.6            | 28.9              | 28.9   | 100.0                                 |
| Terminal Railroad Association of St. Louis..... |                          | 6.0            |              |              | 6.0             |                             | 1.1            |              |              | 1.1             | 7.1               | 12.6   | 56.3                                  |
| Ulster & Delaware.....                          | 25.0                     |                |              |              | 25.0            |                             |                |              |              |                 | 25.0              | 126.3  | 19.8                                  |
| Union.....                                      |                          | 0.6            |              |              | 0.6             | 2.4                         |                |              |              | 2.4             | 3.0               | 7.4  | 40.5                                  |
| Union Pacific.....                              | 819.5                    | 356.8          |              | 2.2          | 1,178.5         | 11.1                        |                |              |              | 11.1            | 1,189.6           | 2,917.0  | 40.8                                  |
| Oregon Short Line.....                          | 176.8                    |                |              |              | 176.8           |                             |                |              |              |                 | 176.8             | 1,368.9  | 12.9                                  |
| Oregon Railroad & Navigation Co.....            | 297.0                    |                |              |              | 297.0           |                             |                |              |              |                 | 297.0             | 1,248.6  | 23.8                                  |
| Vandalia.....                                   |                          |                |              |              |                 | 216.6                       | 22.0           |              |              | 238.6           | 238.6             | 796.7  | 30.0                                  |
| Wabash.....                                     |                          | 19.6           |              |              | 19.6            | 1,726.7                     | 113.8          |              |              | 1,840.5         | 1,860.1           | 1,987.1  | 98.6                                  |
| Wabash Pittsburgh Terminal.....                 |                          | 4.8            |              |              | 4.8             |                             |                |              |              |                 | 4.8               | 63.5   | 7.4                                   |
| Washington Southern.....                        |                          |                |              |              |                 |                             | 34.2           |              |              | 34.2            | 34.2              | 34.2   | 100.0                                 |
| Wisconsin Central.....                          |                          |                |              |              |                 |                             | 4.4            |              |              | 4.4             | 4.4               | 783.2  | 0.5                                   |
| <b>Total.....</b>                               | <b>4,363.5</b>           | <b>5,699.8</b> | <b>197.8</b> | <b>541.9</b> | <b>10,803.0</b> | <b>38,517.0</b>             | <b>8,447.6</b> | <b>258.8</b> | <b>652.3</b> | <b>47,875.7</b> | <b>58,678.7</b>   | <b>151,455.2</b>                                   |                                       |

<sup>a</sup> Includes Cleveland, Lorain & Wheeling.

<sup>b</sup> Manual block system on 8.9 miles used exclusively by freight trains not shown in this table.

<sup>c</sup> Electric road.

<sup>d</sup> Includes Syracuse, Binghamton & New York.

<sup>e</sup> Includes Yazoo & Mississippi Valley.

<sup>f</sup> Automatic signals in addition to telegraph block on 6.6 miles. Automatic signals on 167.2 miles and nonautomatic signals on 57 miles used in whole or in part exclusively by freight trains.

<sup>g</sup> The Michigan Central has 243.5 miles automatic block signals in Canada not shown in this table.

<sup>h</sup> Includes Peoria & Eastern.

<sup>i</sup> Includes Northern Ohio.

<sup>j</sup> Includes 19.6 miles of road of more than four tracks.

<sup>k</sup> Automatic block signals on 16.3 miles used exclusively by freight trains not shown in this table.

TABLE 2.—KINDS OF AUTOMATIC SIGNALS IN USE.

| Names of railroads.                             | Uninclosed disks ("clock-work"). |                 | Inclosed disks. |                 | Semaphores.        |                 |                 |                 |                |                 |                |                 | Normal clear, miles of track. | Normal danger, miles of track. | Total automatic signals. |         |
|---|----------------------------------|-----------------|-----------------|-----------------|--------------------|-----------------|-----------------|-----------------|----------------|-----------------|----------------|-----------------|-------------------------------|--------------------------------|--------------------------|---------|
|   | Miles of road.                   | Miles of track. | Miles of road.  | Miles of track. | Electro-pneumatic. |                 | Electric motor. |                 | Electro-gas.   |                 | Miles of road. | Miles of track. |                               |                                |                          |         |
|   |                                  |                 |                 |                 | Miles of road.     | Miles of track. | Miles of road.  | Miles of track. | Miles of road. | Miles of track. |                |                 |                               |                                |                          |         |
| Alabama Great Southern.....                     | 14.5                             | 14.5            |                 |                 |                    |                 | 31.1            | 31.1            |                |                 |                |                 | 45.6                          |                                | 45.6                     | 45.6    |
| Atchison, Topeka & Santa Fe.....                |                                  |                 | 4.6             | 9.2             |                    |                 | 15.6            | 31.2            |                |                 |                |                 | 40.4                          |                                | 20.2                     | 40.4    |
| Atlantic City.....                              |                                  |                 | 86.7            | 173.4           |                    |                 |                 |                 |                |                 |                |                 | 173.4                         |                                | 86.7                     | 173.4   |
| Baltimore & Ohio.....                           |                                  |                 | 9.5             | 9.5             |                    |                 | 39.1            | 76.2            | 94.2           | 188.4           |                |                 | 12.6                          | 261.5                          | 142.8                    | 274.1   |
| Boston & Albany.....                            | 120.2                            | 247.0           | 10.0            | 40.0            |                    |                 | 28.0            | 67.8            | 13.0           | 26.0            |                |                 | 314.8                         | 66.0                           | 171.2                    | 380.8   |
| Boston & Maine.....                             | 20.6                             | 41.2            | 1.3             | 3.1             |                    |                 | 147.7           | 270.0           | 8.9            | 17.8            |                |                 | 312.7                         | 19.4                           | 178.5                    | 332.1   |
| Central of New Jersey.....                      |                                  |                 |                 |                 | 29.7               | 116.0           | 163.3           | 318.6           | 19.4           | 38.0            |                |                 | 434.6                         | 38.0                           | 212.4                    | 472.6   |
| Chicago & Alton.....                            |                                  |                 |                 |                 |                    |                 | 311.4           | 452.5           |                |                 |                |                 | 135.8                         | 316.7                          | 311.4                    | 452.5   |
| Chicago & Eastern Illinois.....                 |                                  |                 | 8.7             | 13.8            |                    |                 | 98.4            | 196.8           |                |                 |                |                 | 210.6                         |                                | 107.1                    | 210.6   |
| Chicago & Northwestern.....                     |                                  |                 | 599.8           | 1,216.9         | 6.3                | 12.6            |                 |                 |                |                 |                |                 | 1,229.5                       |                                | 606.1                    | 1,229.5 |
| Chicago & Western Indiana.....                  |                                  |                 |                 |                 |                    |                 | 7.5             | 15.0            |                |                 |                |                 | 15.0                          |                                | 7.5                      | 15.0    |
| Chicago, Burlington & Quincy.....               |                                  |                 | 26.9            | 53.8            | 5.5                | 22.0            | 3.9             | 3.9             |                |                 |                |                 | 75.8                          | 3.9                            | 36.3                     | 79.7    |
| Chicago Great Western.....                      |                                  |                 |                 |                 |                    |                 | 7.9             | 15.8            |                |                 |                |                 | 15.8                          |                                | 7.9                      | 15.8    |
| Chicago, Indiana & Southern.....                |                                  |                 |                 |                 |                    |                 | 2.0             | 4.0             |                |                 |                |                 |                               | 4.0                            | 2.0                      | 4.0     |
| Chicago, Milwaukee & St. Paul.....              |                                  |                 | 5.7             | 9.0             |                    |                 | 34.7            | 69.4            | 3.5            | 3.5             |                |                 | 68.4                          | 13.5                           | 43.9                     | 81.9    |
| Chicago, Rock Island & Pacific.....             |                                  |                 | 7.9             | 15.0            |                    |                 | 145.0           | 290.0           | 0.2            | 0.2             |                |                 | 305.2                         |                                | 153.1                    | 305.2   |
| Chicago, St. Paul, Minneapolis & Omaha.....     |                                  |                 |                 |                 |                    |                 | 6.4             | 12.8            |                |                 |                |                 | 12.8                          |                                | 6.4                      | 12.8    |
| Chicago Terminal Transfer.....                  |                                  |                 | 1.0             | 2.0             | 3.2                | 6.4             | 1.2             | 2.4             |                |                 |                |                 | 10.8                          |                                | 5.4                      | 10.8    |
| Cincinnati, New Orleans & Texas Pacific.....    | 39.0                             | 39.0            | 56.1            | 56.1            |                    |                 | 228.3           | 281.6           | 5.0            | 8.0             |                |                 | 382.9                         | 1.8                            | 328.4                    | 384.7   |
| Delaware & Hudson.....                          |                                  |                 | 37.8            | 75.6            |                    |                 |                 |                 | 369.8          | 601.6           |                |                 |                               | 677.2                          | 407.6                    | 677.2   |
| Delaware, Lackawanna & Western.....             |                                  |                 | 11.0            | 20.6            |                    |                 | 445.5           | 897.1           |                |                 |                |                 | 917.7                         |                                | 456.5                    | 917.7   |
| Erie.....                                       |                                  |                 |                 |                 |                    |                 | 73.6            | 175.6           |                |                 |                |                 |                               | 175.6                          | 73.6                     | 175.6   |
| Galveston, Harrisburg & San Antonio.....        |                                  |                 | 1.7             | 1.7             |                    |                 | 37.8            | 37.8            |                |                 |                |                 | 39.5                          |                                | 39.5                     | 39.5    |
| Great Northern.....                             |                                  |                 | 68.2            | 130.2           |                    |                 |                 |                 |                |                 |                |                 | 127.0                         | 3.2                            | 68.2                     | 130.2   |
| Illinois Central.....                           |                                  |                 | 25.9            | 63.6            |                    |                 | 78.0            | 146.8           | 157.4          | 314.7           |                |                 | 373.6                         | 151.5                          | 261.3                    | 525.1   |
| Lake Shore & Michigan Southern.....             |                                  |                 | 5.1             | 10.2            |                    |                 | 319.9           | 714.4           | 175.5          | 585.2           |                |                 | 724.6                         | 585.2                          | 499.6                    | 1,309.8 |
| Lehigh Valley.....                              |                                  |                 | 262.8           | 550.2           |                    |                 | 193.6           | 404.7           | 14.1           | 28.2            |                |                 |                               | 983.1                          | 470.5                    | 983.1   |
| Long Island.....                                |                                  |                 |                 |                 |                    |                 | 72.9            | 149.2           |                |                 |                |                 | 145.2                         | 4.0                            | 72.9                     | 149.2   |
| Louisiana & Western.....                        |                                  |                 |                 |                 |                    |                 | 103.6           | 103.6           |                |                 |                |                 | 103.6                         |                                | 103.6                    | 103.6   |
| Louisville & Nashville.....                     |                                  |                 |                 |                 |                    |                 | 7.0             | 7.0             |                |                 |                |                 | 7.0                           |                                | 7.0                      | 7.0     |
| Maine Central.....                              |                                  |                 |                 |                 |                    |                 | 91.5            | 120.7           |                |                 |                |                 | 120.7                         |                                | 91.5                     | 120.7   |
| Michigan Central.....                           |                                  |                 | 97.3            | 194.6           |                    |                 | 174.7           | 349.4           |                |                 |                |                 | 544.0                         |                                | 272.0                    | 544.0   |
| Missouri Pacific.....                           |                                  |                 |                 |                 |                    |                 | 149.9           | 173.8           |                |                 |                |                 | 173.8                         |                                | 149.9                    | 173.8   |
| Mobile & Ohio.....                              |                                  |                 |                 |                 |                    |                 | 4.7             | 9.5             |                |                 |                |                 | 9.5                           |                                | 4.7                      | 9.5     |
| Monongahela.....                                |                                  |                 |                 |                 |                    |                 | 0.5             | 0.5             |                |                 |                |                 | 0.5                           |                                | 0.5                      | 0.5     |
| Morgan's Louisiana & Texas.....                 |                                  |                 |                 |                 |                    |                 | 94.4            | 94.4            |                |                 |                |                 | 94.4                          |                                | 94.4                     | 94.4    |
| New Jersey & New York.....                      |                                  |                 |                 |                 |                    |                 | 10.5            | 21.0            |                |                 |                |                 |                               | 21.0                           | 10.5                     | 21.0    |
| New York & Long Branch.....                     |                                  |                 |                 |                 |                    |                 | 38.0            | 76.0            |                |                 |                |                 | 76.0                          |                                | 38.0                     | 76.0    |
| New York Central & Hudson River.....            |                                  |                 | 11.2            | 22.4            |                    |                 | 124.3           | 277.6           | 8.1            | 16.2            |                |                 | 316.2                         |                                | 143.6                    | 316.2   |
| New York, New Haven & Hartford.....             | 168.5                            | 315.0           | 64.2            | 128.4           |                    |                 | 18.9            | 36.5            |                |                 |                |                 | 479.9                         |                                | 251.6                    | 479.9   |
| New York, Ontario & Western.....                | 134.8                            | 237.7           |                 |                 |                    |                 |                 |                 |                |                 |                |                 | 237.7                         |                                | 134.8                    | 237.7   |
| Norfolk & Western.....                          |                                  |                 |                 |                 | 11.9               | 22.7            | 18.5            | 37.0            |                |                 |                |                 |                               | 59.7                           | 30.4                     | 59.7    |
| Northeast Pennsylvania.....                     |                                  |                 | 4.8             | 6.7             |                    |                 |                 |                 |                |                 |                |                 |                               | 6.7                            | 4.8                      | 6.7     |
| Northern Pacific.....                           |                                  |                 | 3.0             | 4.5             |                    |                 | 11.4            | 22.8            | 4.5            | 6.6             |                |                 | 25.5                          | 8.4                            | 18.9                     | 33.9    |
| Oregon Railroad & Navigation Co.....            |                                  |                 | 2.0             | 2.0             |                    |                 | 295.0           | 295.0           |                |                 |                |                 | 297.0                         |                                | 297.0                    | 297.0   |
| Oregon Short Line.....                          |                                  |                 | 22.3            | 22.3            |                    |                 | 154.5           | 154.5           |                |                 |                |                 | 176.8                         |                                | 176.8                    | 176.8   |
| Pennsylvania.....                               |                                  |                 | 4.5             | 9.0             | 227.2              | 834.6           | 5.7             | 11.4            |                |                 |                |                 | 855.0                         |                                | 237.4                    | 855.0   |
| Pennsylvania Company.....                       |                                  |                 |                 |                 |                    |                 | 108.0           | 274.1           |                |                 |                |                 | 274.1                         |                                | 108.0                    | 274.1   |
| Pere Marquette.....                             |                                  |                 | 3.2             | 3.2             |                    |                 | 2.9             | 2.9             |                |                 |                |                 | 6.1                           |                                | 6.1                      | 6.1     |
| Philadelphia & Frankford.....                   |                                  |                 | 2.6             | 2.6             |                    |                 |                 |                 |                |                 |                |                 |                               | 2.6                            | 2.6                      | 2.6     |
| Philadelphia & Reading.....                     |                                  |                 | 344.8           | 757.7           | 0.7                | 1.4             |                 |                 |                |                 | 14.2           | 20.5            | 0.6                           | 779.0                          | 359.7                    | 779.6   |
| Philadelphia, Baltimore & Washington.....       |                                  |                 |                 |                 | 33.0               | 108.0           |                 |                 |                |                 |                |                 | 108.0                         |                                | 33.0                     | 108.0   |
| Philadelphia, Newton & New York.....            |                                  |                 | 7.7             | 16.7            |                    |                 |                 |                 |                |                 |                |                 |                               | 16.7                           | 7.7                      | 16.7    |
| Pittsburg & Lake Erie.....                      |                                  |                 |                 |                 |                    |                 | 140.1           | 350.2           |                |                 |                |                 | 350.2                         |                                | 140.1                    | 350.2   |
| Pittsburg, Cincinnati, Chicago & St. Louis..... |                                  |                 |                 |                 |                    |                 | 7.2             | 14.4            |                |                 |                |                 | 14.4                          |                                | 7.2                      | 14.4    |
| St. Louis & San Francisco.....                  |                                  |                 | 8.0             | 11.0            |                    |                 | 33.2            | 46.4            |                |                 |                |                 | 56.4                          | 1.0                            | 41.2                     | 57.4    |
| St. Louis Merchants Bridge Terminal.....        |                                  |                 |                 |                 |                    |                 | 5.7             | 11.4            |                |                 |                |                 | 11.4                          |                                | 5.7                      | 11.4    |
| St. Clair Tunnel.....                           |                                  |                 |                 |                 | 2.0                | 2.0             |                 |                 |                |                 |                |                 |                               | 2.0                            | 2.0                      | 2.0     |
| San Pedro, Los Angeles & Salt Lake.....         |                                  |                 |                 |                 |                    |                 | 1.1             | 1.1             |                |                 |                |                 | 1.1                           |                                | 1.1                      | 1.1     |
| Southern Illinois & Missouri Bridge.....        |                                  |                 |                 |                 |                    |                 | 4.6             | 9.3             |                |                 |                |                 | 9.3                           |                                | 4.6                      | 9.3     |
| Southern Pacific Co.:<br>Pacific System.....    |                                  |                 | 2.4             | 2.4             | 6.0                | 13.7            | 1,744.6         | 1,870.9         |                |                 |                |                 | 1,887.0                       |                                | 1,753.0                  | 1,887.0 |
| Staten Island Rapid Transit.....                |                                  |                 | 8.3             | 15.3            |                    |                 |                 |                 |                |                 |                |                 |                               | 15.3                           | 8.3                      | 15.3    |
| Syracuse, Binghamton & New York.....            |                                  |                 | 10.0            | 20.0            |                    |                 |                 |                 |                |                 |                |                 | 20.0                          |                                | 10.0                     | 20.0    |
| Terminal Railroad Association of St. Louis..... |                                  |                 |                 |                 |                    |                 | 6.0             | 12.0            |                |                 |                |                 | 12.0                          |                                | 6.0                      | 12.0    |
| Texas & New Orleans.....                        |                                  |                 |                 |                 |                    |                 | 106.7           | 106.7           |                |                 |                |                 | 106.7                         |                                | 106.7                    | 106.7   |
| Ulster & Delaware.....                          |                                  |                 |                 |                 |                    |                 | 25.0            | 25.0            |                |                 |                |                 | 25.0                          |                                | 25.0                     | 25.0    |
| Union.....                                      |                                  |                 | 0.6             | 1.2             |                    |                 |                 |                 |                |                 |                |                 | 1.2                           |                                | 0.6                      | 1.2     |
| Union Pacific.....                              |                                  |                 | 10.4            | 20.8            |                    |                 | 1,132.8         | 1,450.5         | 35.3           | 70.6            |                |                 | 1,541.9                       |                                | 1,178.5                  | 1,541.9 |
| Wabash.....                                     |                                  |                 |                 |                 |                    |                 | 19.6            | 39.2            |                |                 |                |                 | 39.2                          |                                | 19.6                     | 39.2    |
| Wabash Pittsburgh Terminal.....                 |                                  |                 |                 |                 |                    |                 | 4.8             | 9.6             |                |                 |                |                 | 9.6                           |                                | 4.8                      | 9.6     |
| West Jersey & Seashore.....                     |                                  |                 |                 |                 | 91.2               | 194.4           |                 |                 |                |                 |                |                 | 194.4                         |                                | 91.2                     | 194.4   |
| Yazoo & Mississippi Valley.....                 |                                  |                 |                 |                 |                    |                 | 6.6             | 6.6             |                |                 |                |                 | 6.6                           |                                | 6.6                      | 6.6     |
| Total.....                                      | 497.6                            | 894.4           | 1,838.0         | 3,694.7         | 416.7              | 1,333.8         | 7,143.9         | 10,655.7        | 923.1          | 1,925.5         | 14,317.1       | 4,217.0         | 10,819.3                      | 18,534.1                       |                          |         |

<sup>a</sup> Three-position signals.

<sup>b</sup> Includes 7.9 miles single track and 8.4 miles double track protected by automatic signals used exclusively for freight trains not shown in mileage table.

TABLE 3.—METHODS AND APPARATUS USED WITH MANUAL BLOCK SYSTEM.

| Names of railroads.  | Morse telegraph. |                 | Telephone.     |                 | Electric bells. |                 | "Controlled."  |                 |                |                 |                |                 | Electric train staff. |                 | Block signal stations. |                          |
|--|------------------|-----------------|----------------|-----------------|-----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|-----------------------|-----------------|------------------------|--------------------------|
|  | Miles of road.   | Miles of track. | Miles of road. | Miles of track. | Miles of road.  | Miles of track. | Miles of road. | Miles of track. | Miles of road. | Miles of track. | Miles of road. | Miles of track. | Miles of road.        | Miles of track. | Total number.          | Number closed part time. |
| Alabama Great Southern.....  | 1.5              | 3.0             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 2                      |                          |
| Ann Arbor.....   | 1.0              | 1.0             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 2                      |                          |
| Atchison & Eastern Bridge.....   |                  |                 | 0.4            | 0.4             |                 |                 |                |                 |                |                 |                |                 |                       |                 | 2                      |                          |
| Atchison, Topeka & Santa Fe.....   |                  |                 | 1,437.5        | 1,765.0         |                 |                 |                |                 |                |                 |                |                 | 34.3                  | 34.3            | 301                    | 20                       |
| Atlanta & West Point.....  | 6.0              | 12.0            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 3                      |                          |
| Atlantic & St. Lawrence.....   | 165.1            | 165.1           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 34                     | 6                        |
| Atlantic City.....   | 23.5             | 23.5            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 7                      |                          |
| Atlantic Coast Line.....   | 587.0            | 649.4           | 2.4            | 2.4             |                 |                 |                |                 |                |                 |                |                 |                       |                 | 128                    | a 29                     |
| Baltimore & Ohio.....  | 903.6            | 1,700.0         |                |                 |                 |                 |                |                 |                |                 | 8.4            | 8.4             |                       |                 | 281                    | 8                        |
| Baltimore & Ohio Southwestern.....   | 59.4             | 114.5           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 26                     | 4                        |
| Baltimore & Sparrow's Point.....   | 3.0              | 6.0             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 3                      | 3                        |
| Bessemer & Lake Erie.....  | 195.0            | 279.9           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 63                     | 10                       |
| Boston & Albany.....   |                  |                 | 1.2            | 3.8             |                 |                 |                |                 |                |                 | 1.7            | 6.8             |                       |                 | 11                     |                          |
| Boston & Maine.....  | 118.8            | 211.1           |                |                 |                 |                 |                |                 | 4.8            | 9.6             |                |                 |                       |                 | 35                     | 10                       |
| Buffalo, Rochester & Pittsburgh.....   | 421.9            | 535.2           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 105                    | 38                       |
| Caldwell & Northern.....   | 2.4              | 2.4             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 2                      |                          |
| Camden Interstate.....   | 65.1             | 80.1            |                |                 |                 |                 | 16.0           | 16.0            |                |                 |                |                 |                       |                 | 17                     |                          |
| Central of Georgia.....  |                  |                 |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 21                     | 2                        |
| Central Vermont.....   |                  |                 |                |                 |                 |                 |                |                 |                |                 | 1.5            | 1.5             |                       |                 | 2                      |                          |
| Chesapeake & Ohio.....   | 1,206.9          | 1,391.1         |                |                 |                 |                 | 147.4          | 147.4           | 92.1           | 188.2           | 28.9           | 38.8            | 7.7                   | 7.7             | 224                    | 83                       |
| Chicago & Alton.....   | 352.1            | 390.0           |                |                 |                 |                 |                |                 | 19.2           | 19.2            |                |                 | 18.0                  | 18.0            | 71                     | 14                       |
| Chicago & Eastern Illinois.....  | 226.9            | 284.4           |                |                 |                 |                 | 69.4           | 77.5            |                |                 |                |                 |                       |                 | 54                     | 10                       |
| Chicago & Erie.....  | 248.8            | 257.6           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 60                     | 8                        |
| Chicago & Northwestern.....  | 2,583.4          | 2,811.9         |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 450                    | 261                      |
| Chicago & Western Indiana.....   |                  |                 |                |                 | 19.8            | 39.6            |                |                 |                |                 |                |                 |                       |                 | 28                     |                          |
| Chicago, Burlington & Quincy.....  | 6,745.1          | 6,927.2         | 752.9          | 1,110.0         |                 |                 | 1,251.9        | 1,251.9         |                |                 | 61.3           | 67.0            | 1.3                   | 1.3             | 1,164                  | 618                      |
| Chicago, Detroit & Canada Grand Trunk Junction.....                            | 57.6             | 60.1            |                |                 |                 |                 |                |                 |                |                 | 0.5            | 0.5             | 1.6                   | 1.6             | 14                     | 5                        |
| Chicago Great Western.....   | 288.9            | 315.7           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 66                     | 6                        |
| Chicago, Indiana & Southern.....   | 16.7             | 16.7            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 5                      | 3                        |
| Chicago, Milwaukee & St. Paul.....   | 4,543.5          | 4,929.9         |                |                 |                 |                 |                |                 |                |                 | 1.0            | 1.0             | 8.5                   | 8.5             | 615                    | 267                      |
| Chicago, Rock Island & Pacific.....  | 861.6            | 980.2           |                |                 |                 |                 |                |                 |                |                 |                |                 | 9.0                   | 9.0             | 170                    | 37                       |
| Chicago, St. Paul, Minneapolis & Omaha.....                                    | 655.7            | 719.8           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 126                    | a 36                     |
| Cincinnati & Muskingum Valley.....   | 11.4             | 11.4            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 3                      |                          |
| Cincinnati, Hamilton & Dayton.....   | 100.9            | 128.8           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 31                     |                          |
| Cincinnati, New Orleans & Texas Pacific.....                                   | 2.5              | 2.5             |                |                 |                 |                 |                |                 |                |                 | 2.1            | 2.1             | 0.9                   | 0.9             | 6                      |                          |
| Cleveland, Akron & Columbus.....   | 19.0             | 27.0            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 17                     |                          |
| Cleveland, Cincinnati, Chicago & St. Louis.....                                | 873.0            | 1,163.2         |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 221                    | 21                       |
| Cornwall & Lebanon.....  | 22.0             | 35.7            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 7                      | 7                        |
| Cumberland & Pennsylvania.....   | 7.3              | 13.3            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 9                      | 3                        |
| Cumberland Valley.....   | 28.9             | 39.0            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 12                     |                          |
| Davenport, Rock Island & North-western.....                                    |                  |                 |                |                 |                 |                 | 41.7           | 42.8            |                |                 |                |                 |                       |                 | 7                      | 6                        |
| Delaware & Hudson.....   |                  |                 | 6              | 6               |                 |                 |                |                 |                |                 |                |                 |                       |                 | 2                      |                          |
| Detroit, Grand Haven & Milwaukee.....  | 189.5            | 192.5           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 39                     | 25                       |
| Erie.....  | 545.3            | 712.9           |                |                 | 722.1           | 1,178.4         |                |                 |                |                 |                |                 |                       |                 | 371                    | 75                       |
| Grand Rapids & Indiana.....  | 2.2              | 4.4             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 3                      | a 3                      |
| Grand Rapids Terminal.....   | 1.6              | 2.0             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 2                      |                          |
| Grand Trunk Railway System: International boundary to Black Rock Junction..... |                  |                 |                |                 | .7              | .7              |                |                 |                |                 |                |                 |                       |                 | 2                      |                          |
| Grand Trunk Western.....   | 330.9            | 654.8           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 74                     | 34                       |
| Great Northern.....  | 237.5            | 237.5           |                |                 |                 |                 |                |                 |                |                 |                |                 | 14.6                  | 14.6            | 48                     |                          |
| Hocking Valley.....  | 74.7             | 74.7            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 24                     |                          |
| Illinois Central.....  |                  |                 | 769.1          | 769.1           |                 |                 | 769.1          | 769.1           |                |                 |                |                 |                       |                 | 188                    |                          |
| Iowa Central.....  | 27.8             | 27.8            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 7                      | 2                        |
| Kentucky & Indiana Bridge & Railroad Co.....                                   | 10.6             | 14.7            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 10                     |                          |
| Lackawanna & Wyoming Valley.....   |                  |                 | 1.2            | 2.4             |                 |                 |                |                 |                |                 |                |                 | 2.2                   | 3.4             | 2                      | 1                        |
| Lake Erie & Western.....   | 18.6             | 27.5            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 13                     |                          |
| Lake Shore & Michigan Southern.....  | 993.9            | 1,037.5         |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 190                    | 104                      |
| Lehigh Valley.....   | 744.2            | 802.6           |                |                 |                 |                 |                |                 |                |                 |                |                 | 6.2                   | 6.2             | 120                    | 95                       |
| Long Island.....   |                  |                 |                |                 | 14.1            | 28.2            |                |                 | 8.6            | 17.2            |                |                 |                       |                 | 37                     | 110                      |
| Louisville & Nashville.....  | 484.3            | 523.1           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 115                    | 5                        |
| Michigan Air Line.....   | 105.6            | 105.6           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 19                     | 16                       |
| Michigan Central.....  | 935.2            | 956.6           | 68.0           | 68.0            |                 |                 |                |                 |                |                 |                |                 |                       |                 | 180                    | 87                       |
| Missouri Pacific.....  | 226.3            | 229.6           |                |                 | 0.5             | 0.5             | 1.9            | 1.9             |                |                 | 1.2            | 1.2             |                       |                 | 43                     | 10                       |
| Mobile & Ohio.....   | 42.4             | 42.4            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 15                     |                          |
| Monongahela Connecting.....  | 4.0              | 8.0             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 6                      |                          |
| Nashville, Chattanooga & St. Louis.....  | 97.0             | 104.2           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 37                     |                          |
| New Jersey & New York.....   |                  |                 | 26.1           | 26.1            |                 |                 |                |                 |                |                 |                |                 |                       |                 | 11                     | 5                        |
| New York Central & Hudson River.....   | 2,235.5          | 2,743.8         | 2.9            | 11.6            | 5.3             | 10.6            | 1.4            | 2.8             | 372.9          | 1,302.4         | 70.2           | 234.0           |                       |                 | 342                    | 254                      |
| New York, New Haven & Hartford.....  | 443.8            | 492.6           |                |                 |                 |                 |                |                 | 229.1          | 581.4           | 3.0            | 6.0             |                       |                 | 103                    |                          |
| New York, Susquehanna & Western and Wilkesbarre & Eastern.....                 |                  |                 | 20.7           | 41.4            |                 |                 |                |                 |                |                 |                |                 |                       |                 | 17                     | 2                        |
| Norfolk & Western.....   | 1,060.5          | 1,192.8         |                |                 |                 |                 | 651.7          | 724.9           |                |                 |                |                 |                       |                 | 313                    | 98                       |
| Northeast Pennsylvania.....  |                  |                 |                |                 |                 |                 |                |                 |                |                 |                |                 | 1.7                   | 1.7             | 2                      |                          |
| Northern Central.....  | 429.6            | 607.4           |                |                 |                 |                 |                |                 |                |                 | 0.9            | 1.8             |                       |                 | 115                    | 17                       |
| Northern Pacific.....  | 1,111.5          | 1,336.4         |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 199                    | 10                       |
| Pennsylvania.....  | 1,761.2          | 2,925.9         | 202.6          | 370.2           | 9.4             | 18.8            |                |                 |                |                 | 14.1           | 18.4            |                       |                 | 566                    | 34                       |
| Pennsylvania Company.....  | 758.0            | 1,333.2         | 2.5            | 5.0             |                 |                 |                |                 |                |                 |                |                 |                       |                 | 213                    | 5                        |
| Perkiomen.....   | 38.3             | 38.3            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 13                     | 7                        |
| Peoria & Pekin Union.....  |                  |                 |                |                 |                 |                 | 29.3           | 29.3            |                |                 | 12.7           | 19.2            |                       |                 | 7                      |                          |
| Pere Marquette.....  |                  |                 |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 10                     | 2                        |
| Philadelphia & Reading.....  | 219.9            | 317.0           | 1.1            | 1.3             |                 |                 |                |                 |                |                 | 1.1            | 1.1             | 1.2                   | 1.2             | 92                     | 9                        |
| Philadelphia, Baltimore & Washington.....                                      | 205.6            | 434.0           |                |                 |                 |                 |                |                 |                |                 | 1.6            | 3.2             |                       |                 | 66                     | 1                        |
| Pittsburgh & Lake Erie.....  |                  |                 |                |                 |                 |                 | 31.4           | 34.3            |                |                 |                |                 |                       |                 | 18                     | 10                       |
| Pittsburgh, Cincinnati, Chicago & St. Louis.....                               | 1,081.9          | 1,656.8         |                |                 |                 |                 | 7.7            | 7.7             |                |                 |                |                 |                       |                 | 285                    |                          |
| Reading & Columbia.....  | 35.7             | 35.7            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 12                     | 12                       |
| Richmond, Fredericksburg & Potomac.....  | 87.0             | 164.9           |                |                 |                 |                 |                |                 |                |                 | 0.7            | 0.7             |                       |                 | 10                     |                          |
| St. Louis & San Francisco.....   |                  |                 |                |                 |                 |                 | 344.8          | 361.3           |                |                 | 3.0            | 3.0             |                       |                 | 71                     | 2                        |
| St. Louis-Louisville Lines.....  | 143.7            | 144.7           |                |                 |                 |                 |                |                 |                |                 | 5.9            | 5.9             |                       |                 | 27                     | 6                        |
| St. Louis Merchants Bridge Terminal.....                                       | 1.1              | 2.2             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 3                      |                          |
| Seaboard Air Line.....   | 206.6            | 206.6           |                |                 |                 |                 |                |                 |                |                 | 3.5            | 3.5             |                       |                 | 44                     | 6                        |
| Southern.....  | 1,591.4          | 1,796.6         | 0.5            | 0.5             |                 |                 |                |                 |                |                 | 1.7            | 1.7             |                       |                 | 387                    | 19                       |
| Southern Pacific Company-Pacific System.....                                   |                  |                 |                |                 |                 |                 |                |                 |                |                 | 1.0            | 1.0             | 101.3                 | 101.3           | 37                     |                          |
| Staten Island Rapid Transit.....   |                  |                 |                |                 |                 |                 | 20.7           | 32.4            |                |                 |                |                 |                       |                 | 39                     |                          |
| Terminal Railroad Association of St. Louis.....                                | 1.1              | 2.2             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 2                      |                          |
| Union.....   | 1.0              | 1.0             |                |                 |                 |                 | 0.6            | 0.6             |                |                 | 0.8            | 0.8             |                       |                 | 2                      |                          |
| Union Pacific.....   |                  |                 |                |                 |                 |                 |                |                 |                |                 |                |                 | 11.1                  | 11.1            |                        |                          |
| Vandalia.....  | 238.6            | 260.6           |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 62                     |                          |
| Webster.....   | 1,820.7          | 1,914.7         |                |                 | 19.8            | 39.6            | 1,840.5        | 1,954.3         |                |                 |                |                 |                       |                 | 380                    | 91                       |
| Washington Southern.....   | 34.2             | 68.4            |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 22                     | 3                        |
| West Jersey & Seashore.....  | 51.6             | 51.6            | 29.1           | 58.2            |                 |                 |                |                 |                |                 |                |                 |                       |                 | 25                     | 16                       |
| Wisconsin Central.....   | 4.4              | 8.8             |                |                 |                 |                 |                |                 |                |                 |                |                 |                       |                 | 6                      |                          |
| Yazoo & Mississippi Valley.....  |                  |                 | 14.8           | 14.8            |                 |                 | 14.8           | 14.8            |                |                 |                |                 |                       |                 | 5                      |                          |
| Total.....   | 40,040.3         | 47,781.3        | 3,286.8        | 4,183.3         | 838.5           | 1,383.9         | 5,240.3        | 5,460.0         | 726.7          | 2,118.0         | 212.0          | 410.8           | 234.4                 | 235.6           | 9,438                  | 2,600                    |

a 23 stations closed 7 months; 6 stations closed part of each day.

b Includes Cleveland, Lorain &amp; Wheeling.

c Electric interurban road, using electric, manually operated signals under control of trainmen. Signals furnish both front and rear protection for space of one block.

d 8 stations closed a number of months; 28 closed part of each day.

e 3 stations closed 9 months.

f 6 stations closed six months; 4 closed part of each day.

g In use four months of the year.



TABLE 4.— PRACTICES IN THE OPERATION OF MANUAL BLOCK SYSTEM.

| Names of railroads.  | Permissive signaling not allowed. |                 | Permissive signaling allowed. |                 |                                 |                 |                  |                 | Rear-end protection only. |                 | Signals opposite office. |                 |
|--|-----------------------------------|-----------------|-------------------------------|-----------------|---------------------------------|-----------------|------------------|-----------------|---------------------------|-----------------|--------------------------|-----------------|
|  |                                   |                 | By three-position signals.    |                 | By two-position signal or flag. |                 | By caution card. |                 |                           |                 |                          |                 |
|  | Miles of road.                    | Miles of track. | Miles of road.                | Miles of track. | Miles of road.                  | Miles of track. | Miles of road.   | Miles of track. | Miles of road.            | Miles of track. | Miles of road.           | Miles of track. |
| Alabama Great Southern                                     | 1.5                               | 3.0             |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Ann Arbor  | 1.0                               | 1.0             |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Atchison & Eastern Bridge                                  | 0.4                               | 0.4             |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Atchison, Topeka & Santa Fe                                | 34.3                              | 34.3            | 1,437.5                       | 1,765.0         |                                 |                 |                  |                 |                           |                 |                          |                 |
| Atlanta & West Point                                       | 6.0                               | 12.0            |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Atlantic & St. Lawrence                                    |                                   |                 |                               |                 | a 165.1                         | a 165.1         |                  |                 |                           |                 |                          |                 |
| Atlantic City  | 23.5                              | 23.5            |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Atlantic Coast Line  | 5.3                               | 10.6            |                               |                 |                                 |                 | 584.1            | 641.2           |                           |                 |                          |                 |
| Baltimore & Ohio   | 253.4                             | 433.7           | ab 658.6                      | ab 1,274.7      |                                 |                 |                  |                 |                           |                 |                          |                 |
| Baltimore & Ohio Southwestern                              | c 15.4                            | c 30.8          | a 44.0                        | a 74.9          |                                 |                 |                  |                 |                           |                 |                          |                 |
| Baltimore & Sparrow's Point                                |                                   |                 | d 3.0                         | d 6.0           |                                 |                 |                  |                 |                           |                 |                          |                 |
| Bessemer & Lake Erie                                       |                                   |                 |                               |                 |                                 |                 | a 195.0          | a 279.9         |                           |                 | 193.0                    | 276.9           |
| Boston & Albany  | 2.9                               | 10.6            |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Boston & Maine   | 123.6                             | 220.7           |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Buffalo, Rochester & Pittsburgh                            | 396.0                             | 509.3           |                               |                 | a 25.9                          | a 25.9          |                  |                 |                           |                 |                          |                 |
| Caldwell & Northern  |                                   |                 |                               |                 |                                 |                 | 2.4              | 2.4             |                           |                 |                          |                 |
| Central of Georgia   | 65.1                              | 65.1            |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Central Vermont  | 1.5                               | 1.5             |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Chesapeake & Ohio  |                                   |                 |                               |                 |                                 |                 | d 1,483.0        | d 1,771.2       |                           |                 | 1,039.2                  | 1,081.6         |
| Chicago & Alton  |                                   |                 |                               |                 |                                 |                 | 389.3            | 427.2           |                           |                 |                          |                 |
| Chicago & Eastern Illinois                                 |                                   |                 | b 226.9                       | b 284.4         |                                 |                 |                  |                 |                           |                 | 226.9                    | 284.4           |
| Chicago & Erie   |                                   |                 | a 248.8                       | a 257.6         |                                 |                 |                  |                 |                           |                 | 248.8                    | 257.6           |
| Chicago & Northwestern                                     |                                   |                 |                               |                 |                                 |                 | ad 2,583.4       | ad 2,811.9      |                           |                 | 2,354.9                  | 2,354.9         |
| Chicago & Western Indiana                                  |                                   |                 |                               |                 |                                 |                 | 19.8             | 39.6            |                           |                 |                          |                 |
| Chicago, Burlington & Quincy                               | 82.7                              | 130.6           | 7,477.9                       | 7,975.5         |                                 |                 | a 1,251.9        | a 1,251.9       | 5,165.4                   | 5,171.4         | 8,746.9                  | 9,793.6         |
| Chicago, Detroit & Canada Grand Trunk Junction             |                                   |                 |                               |                 | a 57.4                          | a 60.1          |                  |                 |                           |                 |                          |                 |
| Chicago Great Western                                      | 291.0                             | 317.8           |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Chicago, Indiana & Southern                                |                                   |                 |                               |                 |                                 |                 | 16.7             | 16.7            |                           |                 |                          |                 |
| Chicago, Milwaukee & St. Paul                              | 647.0                             | 669.7           |                               |                 |                                 |                 | ad 3,906.0       | ad 4,268.7      |                           |                 | 4,263.4                  | 4,648.8         |
| Chicago, Rock Island & Pacific                             |                                   |                 | 870.6                         | 989.2           |                                 |                 |                  |                 |                           |                 | 861.6                    | 980.2           |
| Chicago, St. Paul, Minneapolis & Omaha                     | 655.7                             | 719.8           |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Cincinnati & Muskingum Valley                              |                                   |                 | d 11.4                        | d 11.4          |                                 |                 |                  |                 |                           |                 | 11.4                     | 11.4            |
| Cincinnati, Hamilton & Dayton                              |                                   |                 | ae 59.1                       | ae 97.0         | ab 41.8                         | ab 41.8         |                  |                 |                           |                 |                          |                 |
| Cincinnati, New Orleans & Texas Pacific                    | 2.1                               | 2.1             |                               |                 | b 3.4                           | b 3.4           |                  |                 |                           |                 |                          |                 |
| Cleveland, Akron & Columbus                                |                                   |                 | d 19.0                        | d 27.0          |                                 |                 |                  |                 |                           |                 |                          |                 |
| Cleveland, Cincinnati, Chicago & St. Louis                 | 856.6                             | 1,146.8         |                               |                 | 16.4                            | 16.4            |                  |                 |                           |                 | f 873.0                  | f 1,163.2       |
| Cornwall & Lebanon   |                                   |                 |                               |                 | a 22.0                          | a 35.7          |                  |                 | 22.0                      | 35.7            |                          |                 |
| Cumberland & Pennsylvania                                  |                                   |                 | e 7.3                         | e 13.3          |                                 |                 |                  |                 |                           |                 |                          |                 |
| Cumberland Valley  |                                   |                 |                               |                 |                                 |                 | 28.9             | 39.0            |                           |                 |                          |                 |
| Davenport, Rock Island & Northwestern                      |                                   |                 |                               |                 | a 41.7                          | a 42.8          |                  |                 |                           |                 |                          |                 |
| Delaware & Hudson  |                                   |                 |                               |                 | 0.6                             | 0.6             |                  |                 |                           |                 |                          |                 |
| Detroit, Grand Haven & Milwaukee                           |                                   |                 |                               |                 | a 189.0                         | a 192.5         |                  |                 |                           |                 |                          |                 |
| Erie   |                                   |                 | a 1,267.4                     | a 1,891.3       |                                 |                 |                  |                 |                           |                 | 837.9                    | 1,178.1         |
| Grand Rapids & Indiana                                     | 2.2                               | 4.4             |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Grand Rapids Terminal                                      |                                   |                 |                               |                 | a 1.5                           | a 1.9           |                  |                 |                           |                 |                          |                 |
| Grand Trunk Western  |                                   |                 |                               |                 | a 330.9                         | a 654.8         |                  |                 |                           |                 |                          |                 |
| Great Northern   | 14.6                              | 14.6            |                               |                 | ad 237.5                        | ad 237.5        |                  |                 |                           |                 | 237.5                    | 237.5           |
| Hocking Valley   |                                   |                 |                               |                 | a 74.7                          | a 74.7          |                  |                 |                           |                 |                          |                 |
| Illinois Central   |                                   |                 |                               |                 |                                 |                 | d 769.1          | d 769.1         |                           |                 |                          |                 |
| Iowa Central   |                                   |                 |                               |                 | a 27.8                          | a 27.8          |                  |                 |                           |                 |                          |                 |
| Kentucky & Indiana Bridge & Railroad Co.                   |                                   |                 | a 10.6                        | a 14.7          |                                 |                 |                  |                 |                           |                 |                          |                 |
| Lackawanna & Wyoming Valley                                | 2.2                               | 3.2             |                               |                 | 1.2                             | 2.4             |                  |                 |                           |                 |                          |                 |
| Lake Erie & Western  | 18.6                              | 27.5            |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Lake Shore & Michigan Southern                             |                                   |                 |                               |                 |                                 |                 | a 993.9          | a 1,037.5       |                           |                 |                          |                 |
| Lehigh Valley  | 750.4                             | 805.2           |                               |                 |                                 |                 | 22.7             | 45.4            |                           |                 |                          |                 |
| Long Island  |                                   |                 |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Louisville & Nashville                                     |                                   |                 | d 484.3                       | d 523.1         |                                 |                 |                  |                 |                           |                 |                          |                 |
| Michigan Air Line  |                                   |                 |                               |                 | a 105.6                         | a 105.6         |                  |                 |                           |                 |                          |                 |
| Michigan Central   | a 1,003.5                         | a 1,022.6       |                               |                 |                                 |                 |                  |                 | 1,003.5                   | 1,022.6         | 1,003.5                  | 1,022.6         |
| Missouri Pacific   | 7.7                               | 7.7             |                               |                 | 222.2                           | 225.5           |                  |                 | 226.8                     | 230.1           | 226.6                    | 229.9           |
| Mobile & Ohio  | 17.6                              | 17.6            |                               |                 | a 24.8                          | a 24.8          |                  |                 | 24.8                      | 24.8            | 42.4                     | 42.4            |
| Monongahela Connecting                                     |                                   |                 |                               |                 | a 4.0                           | a 8.0           |                  |                 |                           |                 |                          |                 |
| Nashville, Chattanooga & St. Louis                         | 48.1                              | 53.1            |                               |                 |                                 |                 | 48.9             | 51.1            |                           |                 |                          |                 |
| New Jersey & New York                                      |                                   |                 |                               |                 | 26.1                            | 26.1            |                  |                 |                           |                 | 26.1                     | 26.1            |
| New York Central & Hudson River                            | 2,260.8                           | 3,241.8         |                               |                 |                                 |                 | d 427.2          | d 1,054.4       |                           |                 |                          |                 |
| New York, New Haven & Hartford                             | 675.9                             | 1,080.0         |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| New York, Susquehanna & Western and Wilkes-barre & Eastern |                                   |                 |                               |                 | a 20.7                          | a 41.4          |                  |                 |                           |                 | 20.7                     | 41.4            |
| Norfolk & Western  |                                   |                 | 1,712.2                       | 1,917.7         |                                 |                 |                  |                 | 727.2                     | 774.0           |                          |                 |
| Northeast Pennsylvania                                     | 1.7                               | 1.7             |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Northern Central   | 3.4                               | 6.8             | bd 427.0                      | bd 602.3        |                                 |                 |                  |                 | d 187.2                   | d 188.3         | 132.5                    | 197.2           |
| Northern Pacific   |                                   |                 |                               |                 |                                 |                 | 1,111.5          | 1,336.4         |                           |                 |                          |                 |
| Pennsylvania   | 6.7                               | 7.3             | d 1,980.6                     | d 3,326.0       |                                 |                 |                  |                 |                           |                 |                          |                 |
| Pennsylvania Company                                       |                                   |                 | bd 760.5                      | bd 1,338.2      |                                 |                 |                  |                 |                           |                 | 760.5                    | 1,338.2         |
| Perkiomen  |                                   |                 |                               |                 |                                 |                 | bd 38.3          | bd 38.3         |                           |                 |                          |                 |
| Peoria & Pekin Union                                       |                                   |                 |                               |                 |                                 |                 | a 12.7           | a 19.2          |                           |                 |                          |                 |
| Pere Marquette   |                                   |                 |                               |                 |                                 |                 | 29.3             | 29.3            |                           |                 |                          |                 |
| Philadelphia & Reading                                     |                                   |                 |                               |                 |                                 |                 | d 223.3          | d 348.4         |                           |                 |                          |                 |
| Philadelphia, Baltimore & Washington                       | 58.6                              | 126.4           | d 148.6                       | d 310.8         |                                 |                 |                  |                 |                           |                 |                          |                 |
| Pittsburgh & Lake Erie                                     | 31.4                              | 34.3            |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Pittsburgh, Cincinnati, Chicago & St. Louis                |                                   |                 | bd 1,089.6                    | bd 1,664.5      |                                 |                 |                  |                 |                           |                 | 1,089.6                  | 1,664.5         |
| Reading & Columbia   |                                   |                 |                               |                 |                                 |                 | b 35.7           | b 35.7          |                           |                 |                          |                 |
| Richmond, Fredericksburg & Potomac                         | .7                                | .7              |                               |                 |                                 |                 | 87.0             | 164.9           |                           |                 |                          |                 |
| St. Louis & San Francisco                                  |                                   |                 | a 347.8                       | a 364.3         |                                 |                 |                  |                 |                           |                 |                          |                 |
| St. Louis-Louisville Lines                                 | 5.9                               | 5.9             |                               |                 |                                 |                 | a 143.7          | a 144.7         |                           |                 |                          |                 |
| St. Louis Merchants Bridge Terminal                        | 1.1                               | 2.2             |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Seaboard Air Line  |                                   |                 |                               |                 |                                 |                 | a 210.1          | a 210.1         |                           |                 |                          |                 |
| Southern   | 1,560.4                           | 1,755.1         |                               |                 | a 33.6                          | a 44.1          |                  |                 |                           |                 |                          |                 |
| Southern Pacific Company—Pacific System                    | 102.3                             | 102.3           |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Staten Island Rapid Transit                                |                                   |                 |                               |                 | b 20.7                          | b 32.4          |                  |                 |                           |                 |                          |                 |
| Terminal Railroad Association of St. Louis                 | 1.1                               | 2.2             |                               |                 |                                 |                 |                  |                 |                           |                 |                          |                 |
| Union  |                                   |                 |                               |                 | b 2.4                           | b 2.4           |                  |                 |                           |                 |                          |                 |
| Union Pacific  |                                   |                 |                               |                 | 11.1                            | 11.1            |                  |                 |                           |                 |                          |                 |
| Vandalia   |                                   |                 | b 238.6                       | b 260.6         |                                 |                 |                  |                 |                           |                 |                          |                 |
| Wabash   |                                   |                 |                               |                 |                                 |                 | a 1,840.5        | a 1,954.3       |                           |                 |                          |                 |
| Washington Southern  |                                   |                 |                               |                 |                                 |                 | 34.2             | 34.2            | 773.4                     | 773.4           |                          |                 |
| West Jersey & Seashore                                     |                                   |                 |                               |                 | ae 80.7                         | ae 109.8        |                  |                 |                           |                 |                          |                 |
| Wisconsin Central  |                                   |                 |                               |                 |                                 |                 | 4.4              | 8.8             |                           |                 |                          |                 |
| Yazoo & Mississippi Valley                                 |                                   |                 |                               |                 |                                 |                 | d 14.8           | d 14.8          |                           |                 |                          |                 |
| Total  | 10,039.9                          | 12,665.9        | 19,531.3                      | 24,989.5        | 1,788.8                         | 2,214.6         | 16,507.8         | 18,846.3        | 8,130.3                   | 8,220.3         | 23,196.4                 | 26,830.5        |

a By dispatcher.

b Allowed by rule.

c Permissive movements allowed for westbound trains by dispatcher and three-position signal.

d For everything but passenger trains.

e By train order.

f In this mileage there are 58 signals opposite offices.

g Allowed in some cases.

h For passenger trains only. This company uses no block for freight trains on lines protected by manual block system.

x Camden Interstate, 16 miles electric road not shown in this table.

manual block system, and Table 4 shows the practice in vogue in the operation of the manual system. It appears that since September 30, 1906,\* there has been an increase of 9,935.5 miles in block-signal mileage in the United States, the mileage now shown being 58,678.7, while in the earlier report it was 48,743.2. This increase represents 5,959.4 miles of manual and 3,976.1 miles of automatic. The increase in automatics on single-track lines is 2,331.1 miles. On the Lehigh Valley 79 miles of block-signal mileage is used exclusively for freight trains.

It appears from Table 4 that on 8,130.3 miles of road the block system is used for rear-end protection only.

#### China's Plans for New Railroads.

It is a fact worth noting that China now has a ministry of transportation, and that this ministry has reported in favor of a national railroad system, with its center at Pekin, the several lines to be built as means can be provided, those promising immediate profit first. The great north-and-south line will be that now open from Pekin south to the Yang-tze river at Hankow, with its extension south to Canton, together with the line now in operation from Pekin northeast to Hsin-min-tun (near Mukden), to be extended thence northward to the Amoor and the Russian border at Argun, crossing the Chinese Eastern at Tsitsikar. The road now under construction from Pekin northwest to the Great Wall at Kalgan should eventually be extended substantially over the caravan route through Urga to the Siberian border at Kiachta, which is not far from the Russian trans-Baikal railroad. The western line, beginning from a branch of the Pekin-Hankow railroad at a considerable distance south of Pekin, now under construction from Scheng-ting to Tai-juen, is planned for an indefinite western extension, largely through mountains and desert, towards Turkestan. With these main lines a number of branches would connect. The important thing in this report is that China at last desires to have railroads, and a whole system of railroads, and plans for a long time ahead, and for its own national needs.

#### Rail Committee of the Maintenance of Way Association.

The personnel of the American Railway Engineering and Maintenance of Way Association's committee on rail for this year is a notable one, both because of the rank and experience of the railroad officers composing it, and of the great mileage of the lines represented, the total miles being only a little under 100,000. The work which has been assigned to this committee by the Board of Directors of the association, which is given below, is subject to such change as action by the American Railway Association may dictate.

(1) Continue the investigation of the breakage and failure of rails and present summary of conclusions drawn from reports received.

(2) Report on the results obtained from the use of open-hearth steel rails and the chemical composition of such rails.

(3) Report on any recommended changes in specifications for Bessemer steel rails as heretofore adopted by this association.

(4) Present recommendation as to standard rail sections.

(5) Present report showing diagrams or photographs of typical characteristic rail failures corresponding to the classification as given in form M. W. 1,200, Report of Rail Failures in Main Tracks.

The committee is as follows: D. D. Carothers, Chief Engineer, Baltimore & Ohio, Chairman; R. Montfort, Consulting Engineer, Louisville & Nashville, Vice-Chairman; E. B. Ashby, Engineer Maintenance of Way, Lehigh Valley; J. A. Atwood, Chief Engineer, Pittsburgh & Lake Erie; A. S. Baldwin, Chief Engineer, Illinois Central; J. B. Berry, Chief Engineer, Chicago, Rock Island & Pacific; Chas. S. Churchill, Chief Engineer, Norfolk & Western; W. C. Cushing, Chief Engineer Maintenance of Way Southwest System, Pennsylvania Lines West; F. A. Delano, President, Wabash Railroad; Dr. P. H. Dudley, Rail Expert, New York Central Lines; C. H. Ewing, Engineer Maintenance of Way, Philadelphia & Reading; J. F. Hinckley, Chief Engineer, Frisco Railway System; John D. Isaacs, Consulting Engineer, Harriman Lines; Thos. H. Johnson, Consulting Engineer, Pennsylvania Lines West; Howard G. Kelley, Chief Engineer, Grand Trunk Railway System; J. W. Kendrick, Second Vice-President, Atchison, Topeka & Santa Fe System; George W. Kittredge, Chief Engineer, New York Central & Hudson River; D. W. Lum, Chief Engineer Maintenance of Way and Structures, Southern Railway; Jos. T. Richards, Chief Engineer Maintenance of Way, Pennsylvania Railroad; J. P. Snow, Bridge Engineer, Boston & Maine; Robert Trimble, Chief Engineer Maintenance of Way, Northwest System, Pennsylvania Lines.

Messrs. Kittredge and Kelley are past-presidents of the association, and Messrs. Carothers, Churchill, Cushing and Snow are directors.

\*This was the date of the last table issued by the Commission. It was reprinted in the *Railroad Gazette* March 1, 1907.

#### The Last of a Famous Class.

BY W. B. PALEY.

Historians of the locomotive engine all over the world will deplore the disappearance of the famous "Lady of the Lake" class of express engines on the London & North Western. After a career extending over no less than 48 years they have had to succumb to the inevitable, the class of work for which they were suited no longer existing. They had played many parts in their time; in fact, it was long since they had been able to run express trains single-handed, but work within their capacity had been found for them over and over again. This was largely due to the regard felt for them by the late Mr. F. W. Webb, so long the Chief Mechanical Engineer at Crewe, who assisted at preparing the working drawings for them under his predecessor, Mr. John Ramsbottom. In view of the projected acceleration of the Irish mail service between London and Holyhead, designs for an express engine capable of making longer runs than had hitherto been customary were prepared at Crewe in 1859, the first engine of the new type, No. 184, named "Problem," coming out in November of that year. To some extent Mr. Ramsbottom seems to have reproduced the principal features of a successful type of 7-ft. "single" express engines, designed by his predecessor, Mr. F. Trevithick, in 1847, but all the dimensions were enlarged and the important difference made that inside bearings only were used for all the wheels. In the 7-ft. class they had been outside for both pairs of carrying wheels. The cylinders were made 16 x 24, instead of 15 x 20, an additional 6 in. being added to the diameter of the driving wheels. The weight, full, was augmented from about 20 to 27 tons 6 cwts., of which 9 tons 8 cwts. were on the leading, 6 tons 8 cwt. on the trailing and 11½ tons on the driving wheels. The boiler barrel was 10 ft. 5 in. long by 3 ft. 11 in., made of three rings ⅞ iron plates, single riveted, the center line being 6½ ft. above the rails. The firebox shell was flush at the crown with the barrel, 4 ft. 9 in. long by 4 ft., also of ⅞ plates. The firebox itself was 4 ft. 2 in. long, 3 ft. 6 in. wide by 5 ft. 7 in. deep, with sides of copper plates ½ in. thick, the tube plate being of ¾-in. copper. These dimensions gave 85 sq. ft. of heating surface, and as the 192 brass tubes, 1⅞ in. in diameter by 10 ft. 9 in. long, gave 1,013 ft. more on the outside, the total heating surface was 1,098 sq. ft. The grate area was 14.7 sq. ft., the firebar frame consisting of two round bars of iron 3 in. in diameter, resting at each end in a V-seat bolted against the ashpan side, with ¾-in. iron pegs screwed into them, at such distances as to provide an inch clear space for the bars. It was found that this spacing cured the troublesome tendency of the bars to run together. The smokebox was 2 ft. 8 in. long, provided with a door opening upward from the bottom, and also with a funnel-shaped chute to relieve it of ashes, an arrangement specially devised with a view to long runs. The stack was 16 in. in diameter and reached to 13 ft. 1 in. above the rails, an elaborate cap always used by Mr. Ramsbottom surrounding the top. Screw reversing gear was fitted on the left hand, which is the driver's side on the L. & N. W., the length of the links in the motion being 16 in. and the throw of the eccentrics 5¼ in. A large plain dome, of the type still used at Crewe, contained a double-beat regulator valve; the main steam pipe was 5½ in. in diameter. The connecting rods were 6 ft. 3 in. long, with a short fork at the cylinder end, and had cross-head pins 2¼ in. x 2¼ in., the crank-pin bearing being 4 in. in diameter by 4¼ in. long. Single inside plate frames were used of iron 1 in. thick, 4 ft. 1 in. apart and 13 in. deep over the driving fork. Volute springs 5½ in. in diameter, butting against the foot-plate, were used for the trailing wheels, laminated springs 2 ft. 8 in. span, of 14 plates, and 3-ft. span, of 18 plates, for the leading and driving wheels. These, with a wheel base of 7 ft. 7 in. in front of the drivers and of 7 ft. 10 in. behind, made a very steady riding engine only 24 ft. long over all. The cylinders had an internal back cover and were fitted with Ramsbottom's patent pistons, a type then new but now generally used in Great Britain. Two cast-iron rings, cut through so as to be slightly compressible, are sprung into recesses turned in the rim of the piston and kept from turning round by pins screwed into the rim. The engine was fitted with Gifford's injector, then very recently invented; in fact, it was the first engine on the L. & N. W. built with one. There was also a pump capable of supplying the boiler by itself, in case the injector proved unreliable. As to other dimensions the steam pipes were 3¾ in. in diameter, the steam ports 13½ in. x 1½ in., the exhaust ports 3¼ in. wide, lap ⅞ in.; diameter of blast pipe at top 4¼ in. Two safety valves, each 2¾ in. diameter, were fitted on a manhole cover over the firebox, the brass pillars containing them having a strong coiled spring between and a steel lever, connected with both valves, extended over the top of the low weather-board. The blow-off pressure was 120 lbs. A similar engine, No. 229, "Watt," was built at the same time as the "Problem."

Eight others followed within about six months, so that when the improved Irish mail service commenced, on Oct. 1, 1860, the L. & N. W. Company was ready with suitable engines for it. The service comprised a day and a night train in each direction, only the night trains running on Sundays. The speeds were not high,



but the runs were unusually long, including Euston to Rugby, 82¾ miles, and Chester to Holyhead, 84¾. First and second class passengers were taken for Ireland only, and strict clauses as to punctuality were enforced by the terms of the contract with the post office. It had been foreseen, however, that the old 4-wheel tenders, carrying but 1,500 gals. of water, could not be relied upon for covering the exposed stretch of line in North Wales. This led Mr. Ramsbottom to devise an ingenious system of taking up water without stopping the train from a long trough laid between the rails. He patented this in June, 1860, and in the following November a series of experiments was made with a trough laid near Colwyn, about midway between Chester and Holyhead. It was found that 1,200 gals. could easily be picked up from a trough one-quarter mile long, 18 in. wide by 7 deep and containing 5 in. depth of water.

The new engines were provided with 6-wheel tenders to hold 1,800 gals., and with the aid of the water-troughs were able to conduct the mail service with the greatest regularity and satisfaction. They ran between Holyhead and Stafford, 130½ miles, with one stop of 10 minutes at Chester. This was for post office purposes mainly, the place being an important railroad center. South of Stafford the mails were for a short time worked by engines of different type belonging to the Southern Division of the line, but when the separate working of the two divisions was given up, in 1862, a fresh engine of the "Problem" class took up the running from Stafford to London. This arrangement continued for the best part of 20 years, till the trains got altogether too heavy for such light machines. In fact, before long it was often found necessary to use two of them, or a coupled engine, on the Holyhead section, which has some steep bits and is extremely exposed to gales of wind blowing in off the

process, the action continuing so long as the engine was at work or there was any oil left. The lubricator was therefore always full of oil or water, or both, the latter under the oil. Two injectors fed the boiler, one on each side of the firebox. A bronze medal, for excellence of design and workmanship, was awarded, and the engine carried it in a small glass case over the number-plate on the driver's side to the last day of her life.

One of this class, No. 291, "Prince of Wales," was working the down-day mail on Aug. 20, 1868, when near Abergele it was run into by some trucks loaded with casks of oil, which had broken loose from a goods train shunting at the top of an incline. The oil at once caught fire and a fearful holocaust resulted, no fewer than 33 persons being either burned to death or suffocated by the smoke and fumes of the blazing oil. Every scrap of paint was burned off the engine and the bearings melted out.

The average load with the Irish mails between Stafford and Holyhead in the sixties was 10 to 12 four-wheeled vehicles, weighing from 75 to 90 tons in all, taken at a speed of about 45 miles an hour on a consumption of 26½ lbs. of good coal per mile.

In all 60 of the "Problem," or, as they were more often called, the "Lady of the Lake" class were built, the last 10 in 1865. No. 1,434, "Eunomia," the fifty-eighth, was the very last scrapped, just lately. About 1865, owing to increasing loads, Ramsbottom's 6 ft. 6 in. coupled engines, with inside cylinders, 16 x 24, began to replace them. When Mr. Webb's similar, but heavier, 17 x 24 coupled engines came out in 1874 the "Problems" soon got relegated to piloting and to light work off the main line. For some years, about 1890 to 1900, they worked the short fast three-quarter-hour expresses between Liverpool and Manchester with great success, and on the memorable occasion of the "race to Edinburgh," in 1888, No. 667, "Marmion" and 806, "Waverley," worked trains of four 8-wheeled coaches between London and Crewe at extraordinary speeds, 158¼ miles, without a stop.

Down to the time Mr. Webb resigned the whole of the 60 engines were running. They had, of course, all been rebuilt, most of them twice, and considerably modernized. As rebuilt, with larger fireboxes, boilers carrying 150 lbs. steam, their weight was increased about 4 tons to 31 tons 7 cwt., the original load on the drivers of 11½ tons being raised to 14¼. Cabs were added in place of the miserable weather-boards which both Northern and Southern Division engines had so long carried in testimony to the old-fashioned ideas of the respective chiefs. The pattern of nine oval openings in the driving-splashes was done away with; Webb's plain funnel substituted, and the safety-valves enclosed in a neat iron case. Solemn black paint, instead of Ramsbottom's dark green, was used, but

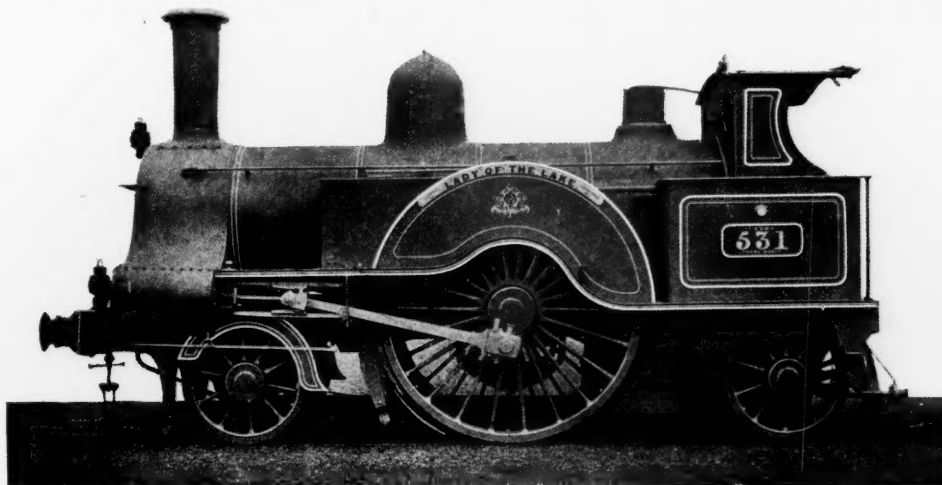
the engines remained about the prettiest little machines that ever ran in Great Britain, and their disappearance will make many a London & North Western man feel that in them he has lost some of his oldest friends.

#### Foreign Railroad Notes.

There died on February 3, 1908, a man who entered the railroad service in Austria in 1839. This man, Wagner von Wagensburg, reached the highest positions in the state railroad service, and was retired on a pension no less than 38 years ago. He was born in 1811.

The government of German Southwest Africa reports that among the difficulties accompanying the extension of its railroad towards Keetmanshoop is the necessity of importing water, which cost on the line just the same as beer in Munich—about 6 cents a quart. Laborers brought in from Upper Silesia wouldn't stay, and Croats were engaged in their place. Native prisoners of war could not stand the climate and the work, and more and more Cape "boys"—that is, natives reared among the Boers—must be depended on to do the earthwork.

Argentina has passed a general railroad law, which will form the uniform basis of all charters granted hereafter by the general government (there are a few state charters), and under which it is intended to bring the older companies as favorable provisions of their old special charters expire. By the new law the railroads will pay 3 per cent. of their net earnings, in lieu of all other taxes, and the proceeds of this tax will be used only for the construction and maintenance of roads and bridges, and particularly of roads leading to the railroad stations. Plans for work for which these expenditures are to be made are to be submitted to a commission consisting of the managers of the railroads.



Express Passenger Locomotive, Lady of the Lake, 1862.

sea. The big 7 ft. 6 in. drivers were considerably affected by the high winds at times.

The year 1862 brought these engines prominently into notice in two respects. On January 7 No. 229, the "Watt," ran from Holyhead to Trent Valley Junction, Stafford, 131 miles, in 144 minutes without stopping, bearing despatches from Lord Lyons, the British Minister at Washington, to the effect that Messrs. Mason and Slidell, who had been taken out of the English steamer "Trent" by the United States ship "San Jacinto," had been released. Opinions were being much agitated by the occurrence; the greatest importance was attached to the quick transit of the despatches. The load was only three vehicles, weighing in all but 20 tons, and the run would have been made considerably faster but for a high wind and the necessity for slowing through such places as Chester and Crewe.

At the Great Exhibition of 1862 the L. & N. W. Company showed one of the "Problem" class, No. 531, "Lady of the Lake." It comprised some additional improvements, such as the tender with water-lifter, and two openings through the front of the firebox, just under the ends of the brick arch and controllable from the foot-plate, in order that air might be admitted to aid in consuming the smoke due to coal fuel. At that time the use of coal for passenger traffic was a new thing in this country, coke having been burned previously, and many devices were tried for securing its perfect combustion without making smoke. These openings were fitted to a large number of L. & N. W. engines at one time. They were about 7 in. square and permitted the fire to shine through them in a peculiar manner. They have long ago been entirely abandoned. The brick arch inclined downward somewhat toward the back of the firebox, instead of upward. Ramsbottom's pistons and his "gravity lubricators" were used, an invention patented in 1860. These were applied to the cylinders and slide-valves and consisted of round brass cups or vessels with narrow necks opening into or connected with the steam chest or cylinder, the vessel was filled with oil and the steam displacing a little from the neck or orifice became condensed. Water being heavier than oil it sank and displaced oil in the

### The Kansas City Terminals of the Missouri, Kansas & Texas.

The Missouri, Kansas & Texas enters Kansas City, Mo., over the tracks of the St. Louis & San Francisco from Paola, Kan. For some years it used also the Frisco freight house and terminals at Kansas City, but on account of the growth of business the contract for joint use of these terminals when it expired was not renewed. Thereupon, the Missouri, Kansas & Texas Terminal Company of Kansas City, was organized and, after considerable difficulty, acquired 50 acres of ground in Rosedale, Kan., for a terminal yard and a tract of land, with a frontage of 1,600 ft., on Wyoming street between 14th and 17th streets, in Kansas City, Mo., for a freight house and house tracks.

This freight house location is near the freight houses of the Rock Island, the St. Paul, the Santa Fe, the Burlington, the Alton, the St. Louis & San Francisco and the Union Pacific, no two of these being more than a block or two apart. The Missouri, Kansas & Texas freight house was finished in the winter of 1906-1907. It consists of a one-story warehouse 34 ft. x 500 ft. and a two-story brick office building 44 ft. x 97 ft. It is used for both inbound and outbound freight and is served by five tracks, with a total length of about two miles. There is room for about the same amount of additional trackage in the future.

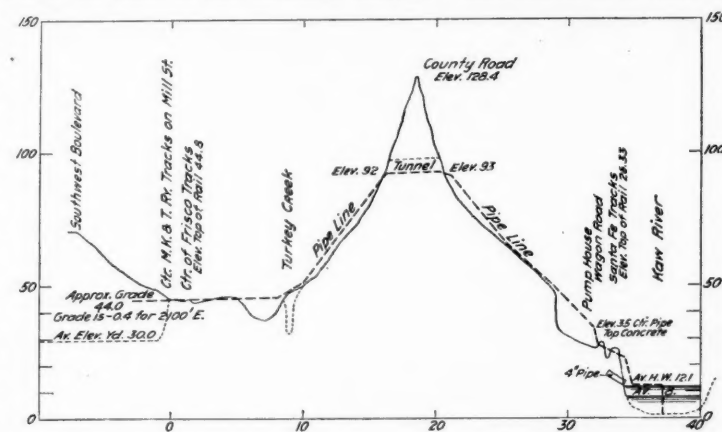
The improvements at Rosedale include a 10-story engine house, with an annex 45 ft. x 80 ft. for machine shop, a 70-ft. manually operated turntable, a 40,000-gal. steel water tank on a steel tower 100 ft. high, two cinder pits, a Robinson cinder conveyor, an ice station and six miles of yard tracks. The yard connects at each end with the main tracks of the St. Louis & San Francisco. Only about one-third of the space available for tracks is so occupied. A plan of the yard and other facilities at Rosedale is shown herewith.

The most interesting feature of the work at Rosedale was the filling of the site which, when acquired, was on an average about 12 ft. below the present grade of the yard. Furthermore, the east end of the track was badly cut up by Turkey creek. A new channel was excavated, involving removal by teams of about 35,000 cu. yds. of material which was deposited on the yard site. In addition 55,000 yds. of material were hauled by teams from neighboring high ground and put on the site. The filling done by teams, however, was less than one-sixth of the total embankment required.

A steam shovel pit was selected on the line of the St. Louis & San Francisco about three miles from the yard site, and it was at first planned to have work trains do most of the filling. This plan was abandoned because work teams would have had to pass over the main tracks of another railroad which might easily have led to frequent delays and perhaps serious accidents. Finally it was proposed to pump sand from the Kaw river. This is nearly one mile north of the new yard and nearly parallel to it, but separated from

by the pipe line, the water finding its way back to the Kaw river by double and its capacity much less than had been estimated. The pump on the barge was able to deliver water and sand (about 90 per cent. of the water and 10 per cent. of sand) to the secondary pump on the bank of the river, faster than the latter could force it over the hill to the further end of the pipe line. After operating at a loss for two months, during which time about 20,000 cu. yds. of sand were deposited on the yard site, the contractor suspended work.

Because of these unfavorable results the man who had furnished the funds for the plant, lost faith in the venture. F. W. Fratt, the Chief Engineer of the terminal company, then offered to release the

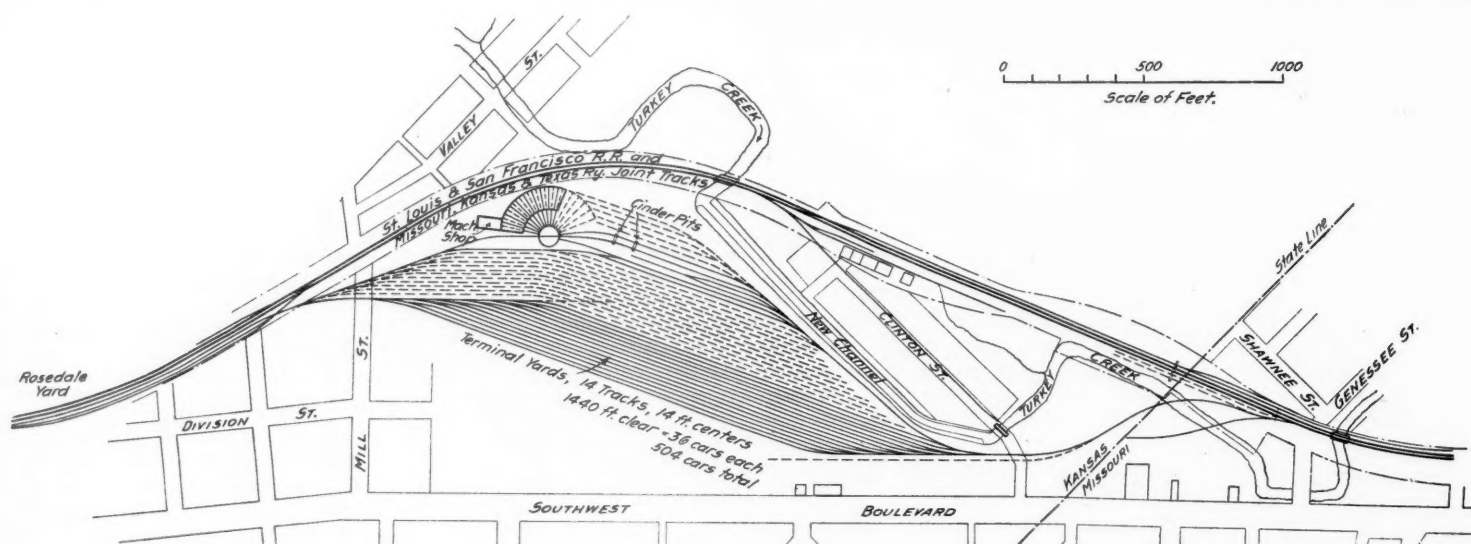


Profile Showing Location of Pipe Line Which Pumped Sand for Filling.

contractor, take charge of the equipment, operate it and pay the owners a certain amount per yard of filling for use of the plant. This proposal was accepted.

Soon after Mr. Fratt took charge he installed a centrifugal pump and a 175-h.p. gas engine on the south side of the hill at about the elevation of the grade of the yard and improved the other pumps. A plan of the pipe line is shown in the accompanying drawing. Work was resumed in April, 1906, and continued with little interruption, except during two winter months, until the filling was finished in October, 1907. There were short delays due to minor accidents to the pipe line and machinery, but on the whole the results of the operation of the plant by the terminal company were satisfactory to all concerned.

The total amount of sand deposited was approximately 480,000 yds., and the cost per yard of the work done by the terminal company, including royalty, but not including engineering, was slightly



New Kansas City Terminal Yard at Rosedale, Kan.; Missouri, Kansas & Texas.

it by a bridge, which is about 120 ft. above low water in the river. A contract was let for doing the filling in this way.

A tunnel 330 ft. long was cut through the ridge at an elevation 80 ft. above low water in the river and 48 ft. above the grade of the yard. A 12-in. wrought-iron spiral pipe of No. 14 B. W. G. was laid from the river to the tunnel and thence to the Rosedale yard. At way of Turkey creek. The cost of the contractor's plant was nearly the river end the pipe was carried on pontoons from the tank to a barge, where it was connected with a centrifugal pump driven by a 150-h.p. steam engine. A 250-h.p. engine and another centrifugal pump were put near the river bank. Natural gas was used for fuel. A dike was built along Turkey creek to retain the sand discharged

under the contract price. When filling was about half completed it was necessary to renew the pipe line throughout, and the second line was practically worthless at the close of the work. The average amount of filling per month was 30,000 cu. yds. The minimum amount per day of 24 hours was 800 yds. and the maximum 1,500 yds. The greatest distance sand was pumped was a little more than 6,000 ft.

The cost of the Missouri, Kansas & Texas terminals in Rosedale and Kansas City was about \$1,250,000, more than half of which was for land. All of the work was in charge of F. W. Fratt, Chief Engineer, and N. M. Fitch, Assistant Engineer, of the Missouri, Kansas & Texas Terminal Company.



# GENERAL NEWS SECTION

## NOTES.

Soap and towels have been removed from the passenger cars of the Nashville, Chattanooga & St. Louis. This is the result of complaints of alleged discrimination against colored passengers.

The Cleveland, Cincinnati, Chicago & St. Louis has again put in service the "Knickerbocker Specials," running between New York and St. Louis in 27 hours, which were taken off last autumn.

In the Canadian Pacific shops at Montreal 800 men have been laid off, most of them being employees of the passenger car repair department. Work on new freight and passenger cars is active at the shops.

The Canadian Pacific Transfer Co. has just received from the builders the car ferry steamer "Charles Lyon," built at Toronto, for use in carrying cars between Prescott, Ont., and Ogdensburg, N. Y. The boat carries 14 cars.

The Nebraska State Supreme Court has granted a restraining order against the express companies doing business in the state, forbidding them to charge rates in excess of the tariffs prescribed by the Sibley act. The order goes into effect April 15. The Sibley act reduces express rates 25 per cent.

Indictments containing 58 counts against the Missouri Pacific and Iron Mountain roads, a former general freight traffic manager of the two companies, and a prominent grain dealer, were returned by the federal grand jury at Little Rock, April 14. They charge the granting and receiving of rebates.

The Canadian Pacific pension department has found that some of the pensions, calculated according to the regulations, were insufficient to protect the recipient against want during his declining years, and the company has modified the regulations so that henceforth the minimum pension shall be \$20 a month.

The Long Island Railroad has filed with the New York State Public Service Commission new passenger tariffs for its Manhattan Beach and Rockaway divisions, increasing some of the fares to 3 cents a mile from 2½ cents. The fare from Long Island City to Manhattan Beach will be 33 cents each way instead of 23 cents as heretofore.

An officer of the Lake Shore & Michigan Southern says that the company will at once put up a telephone line between Buffalo and Erie; and, according to newspaper reports, the telephones are to be used in place of the telegraph for directing the movements of trains. This part of the road is all double-track or four-track and is equipped with automatic block signals.

Judge Calhoun, in a Texas state court, has enjoined the railroad commission of that state from enforcing the use of its new accounting system which it has proposed to require the railroads to use. The new system would be in conflict with that prescribed by the Interstate Commerce Commission, and it is held unreasonable in its requiring the use of averages deduced from theoretical bases.

The Ohio State Railroad Commission has made a rule governing the loading and unloading of cars, providing that when a consignee shall elect to work on a fixed standard of receipts his business shall be rated as to daily capacity and thereafter if the cars consigned to him exceed the rating, he shall be charged each day with 1½ times his rated daily capacity, 48 hours being allowed for unloading each day's placing, actual and constructive.

The Interstate Commerce Commission, ruling on a case where commercial travelers have been in the habit of borrowing tickets from fellow passengers and with them checking baggage on which otherwise excess would be charged, holds such practice to be illegal, as it creates a preference in favor of the passenger who is thus able to borrow, as compared with one who cannot do so. Borrowed tickets may not be used in any case to check baggage.

The State Tax Commission of Wisconsin has fixed the total taxes on railroad property for the present year at \$3,083,720, an increase of \$282,033 over last year. The property is taxed on an ad valorem basis, and the increase of taxes is due to an increase in the valuation from \$255,850,000 to \$267,861,500 and to an increase in the rate from \$10.95 to \$11.51 per \$1,000 of valuation. The rate is the average paid by all other taxable property in the state.

A press despatch from Milwaukee says that Judge Tarrant has handed down a decision upholding the Wisconsin eight-hour law regulating the length of a day's labor by a railroad employee; and at the same time declaring unconstitutional the federal nine-hour law because it attempts to regulate commerce wholly within a state as well as interstate commerce within a state. The suit

is one (begun as a test case) against the Chicago, Milwaukee & St. Paul, and it will be taken as soon as possible to the Supreme Court.

The competition between the transcontinental lines in the carriage of oranges and lemons from southern California to the East is now so sharp that the time to Chicago has been reduced, in the case of many shipments, to eight days, and in some cases to seven days, as against nine days a year ago. The line composed of the San Pedro, Los Angeles & Salt Lake, the Denver & Rio Grande and the Chicago, Burlington & Quincy is said to be making the best time.

The roads between Buffalo and New York have filed new tariffs on domestic grain, effective May 1, showing, on the principal grains, an increase of 8 and 10 per cent. The export grain rates have not been changed. The rates in cents per bushel are as follows:

|                | New rate. | Old rate. |
|----------------|-----------|-----------|
| Wheat .....    | 6½        | 6         |
| Corn .....     | 5¼        | 4¾        |
| Rye .....      | 6         | 5½        |
| Barley .....   | 5¼        | 5         |
| Oats .....     | 4         | 4         |
| Flaxseed ..... | 5½        | 6         |

It is announced that the Pennsylvania Railroad in the year 1907 paid out \$436,006 on claims for losses which were traced to thefts; and the number of arrests made on the company's premises for trespassing was 4,156. This record, which, though not a novel one, is indicative of a fact which receives far too little appreciation, may well justify the company in its renewed appeal to the public and to local magistrates to aid the road in ridding itself of trespassers. Over 800 men were killed or died from injuries received while trespassing on the Pennsylvania lines, east and west, during the year.

The Pennsylvania Railroad, which for several years has had its trains and freight yards well supplied with boxes of appliances for use in "First Aid to the Injured" is paying increased attention to that department this year, and at the lectures to be given to the employees on "first aid" the policemen and firemen of the cities where the lectures are given will be invited to attend. In promoting employees their records as regards attendance at the lectures will be considered. The stretcher which is used on the Pennsylvania Railroad can be taken apart and made into a bundle 3 ft. 6 in. long and 6 in. in diameter.

The New York State Public Service Commission, second district, announces that the complaint of the Watertown Chamber of Commerce against the freight rates charged by the New York Central on its Rome, Watertown and Ogdensburg division has been satisfied by the road, which has given notice of its intention to put in effect rates which will be satisfactory to residents in the northern part of the state. There is to be a new tariff which will reduce rates about 15½ per cent. from existing freight rates and it will be put in effect not later than July 1. In view of this notice the commission has adjourned the hearing indefinitely.

Railroad men in Chicago say that the uniform classification committee, which has been endeavoring since the first of the year to bring about a uniform classification for freight throughout the country, has disbanded. The task of formulating an acceptable uniform classification was found to be absolutely hopeless. No middle ground could be reached. The southern and western roads might possibly have agreed, but the central and eastern roads refused to raise their classification so as to make it conform to the southern and western. The Central Association roads said it would be impossible for them to increase rates, while the southern and western lines declared their inability to exist if they lowered their classification to conform to that of the official and eastern.

The Pennsylvania Railroad Employees' Relief Fund is now 22 years old, and about \$18,000,000 has been paid out in benefits. As is well known, the railroad company not only pays the operating expenses of the relief department, but also makes up deficiencies when, by reason of the small margin allowed in fixing the assessments, the income for any three-year period is insufficient to pay the benefits to which members are entitled under the rules. In the 22 years these deficiencies alone have amounted to \$654,741. In addition to these payments, the company in the first 16 years of the life of the organization paid \$33,919 to sick members whose sickness continued beyond the time (one year) to which they were entitled to benefits from the fund. The membership of the fund is now 95,089, nearly five times as many as in the first year of the organization.

The New York State Public Service Commission, second district, has refused permission to abandon parts of the route of a line of railroad, even a line which parallels an established road and where the two are consolidated. Chairman Stevens says that if abandonment is assented to by the trustees of the mortgage covering

the line, as well as the bondholders and all of the persons along the line of the route who would be affected injuriously, the application would be liable to receive favorable consideration, but the commission would not by any of its acts submit bondholders to possible litigation as to the value of securities. This ruling was given in denying an application of the Central New England for authority to abandon that portion of its line between West Pine Plains and Salt Point, 16 miles. The company by reason of a merger made last year has a line nearly paralleling the portion of road sought to be abandoned. Residents in the territory affected and trustees and holders of the company's income bonds contended that the proposed action would be detrimental to their interests.

Congress has passed an Employers' Liability Bill, but there was no adequate discussion of the measure, and the faults which the Supreme Court found in the former law do not appear to have been cured. Quite unexpectedly the Senate, on April 9, took up for discussion and finally passed without amendment, the bill which was sent over by the House two days before. This bill was quickly substituted for the La Follette measure, reported some time ago by the Senate Committee on Education and Labor. Democrats charged that the measure in the shape it left the House was unconstitutional and had been consciously left in this condition by the Judiciary Committee in order that it might be thrown out by the courts when it came to be put to the test later. This claim was sharply rebutted by Republicans. As passed, the bill is claimed to meet the objections of the Supreme Court to the law of 1896. The bill abolishes the strict common law liability which bars a recovery for personal injury or death of an employee occasioned by the negligence of a fellow servant. It also modifies the common law rule which makes contributory negligence a defense to claims for such injuries, and permits an employee to recover for an injury caused by the negligence of a co-employee. The bill does not bar recovery even though the injured one contributed by his own negligence to the injury, but the amount of the recovery is diminished in the same degree that the negligence of the injured one contributed to the injury.

#### Bethlehem Steel Company.

The third annual report of the Bethlehem Steel Co. shows the following results, with comparisons:

|                                  | 1907.       | 1906.       | 1905.       |
|----------------------------------|-------------|-------------|-------------|
| Net manufacturing profit .....   | \$2,569,252 | \$1,859,353 | \$3,468,802 |
| Total net income .....           | 2,638,957   | 1,364,175   | 3,372,475   |
| Balance, after interest charges. | \$1,618,789 | \$762,749   | \$2,765,399 |
| Depreciation .....               |             |             | 400,000     |
| Net income for year .....        | \$1,618,789 | \$762,749   | \$2,365,399 |
| Previous surplus .....           | 593,421     | 1,843,619   |             |
| Total surp. before dividends     | \$2,212,210 | \$2,606,368 | \$2,365,399 |

#### Locomotive Exports.

Exports of locomotives in the first eight months of the current fiscal year were valued at 5,987,716, a decrease of \$215,824, as shown in the following table:

|                              | 1908.       | 1907.       |
|------------------------------|-------------|-------------|
| Europe .....                 | \$134,552   | \$347,850   |
| British North America .....  | 591,488     | 934,651     |
| Central America .....        | 92,480      | 874,565     |
| Mexico .....                 | 571,442     | 988,696     |
| Cuba .....                   | 527,577     | 684,095     |
| Other West Indies .....      | 48,696      | 12,900      |
| Argentina .....              | 169,315     | 404,948     |
| Brazil .....                 | 525,885     | 135,580     |
| Other South America .....    | 828,502     | 549,647     |
| China .....                  | 109,935     |             |
| Japan .....                  | 265,820     | 1,115,736   |
| British Australasia .....    | 25,440      | 76,316      |
| Philippines .....            | 63,882      | 48,437      |
| Other Asia and Oceania ..... | 2,029,577   |             |
| British Africa .....         | 3,125       |             |
| Other Africa .....           |             | 30,119      |
| Total .....                  | \$5,987,716 | \$6,203,540 |

#### Steel Prices.

E. H. Gary, Chairman of the Board of the United States Steel Corporation, said last week that no reductions in the prevailing prices of steel are contemplated. Prices may be increased or decreased at any time if there is good reason. Prices should at all times be reasonable and fair. The mere fact that the demand is greater than the supply—that the necessities of the purchaser are great—does not justify an increase in price; nor does the fact that the demand is less than the supply furnish an argument for lowering the price. In neither case would the quantity bought and sold be more or less. What the manufacturers and purchasers both, as a rule, desire is stability of prices—the avoidance of violent and sudden fluctuations. If the question of reducing or increasing prices be raised at any time during the next few months, there will be deliberate and orderly consideration.

#### The Standard Storage Battery.

The storage battery shown in the accompanying illustrations is designed on the principle that buckling may be prevented by maintaining a firm contact between the active material and the lead, while at the same time leaving the active material free to expand.

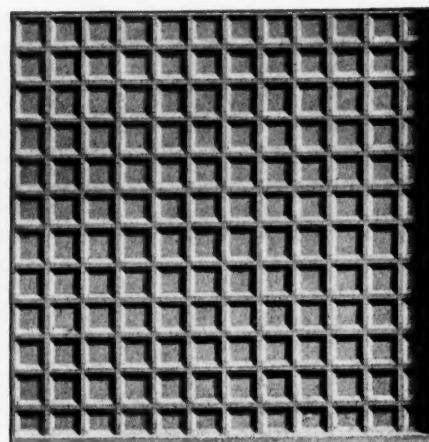


Fig. 1.

Each unit consists of a pair of plates of porous pottery. The inner surface of each has recesses molded in it as shown in Fig. 1, while the outer surface, as shown in Fig. 2, has vertical ribs, which strengthen the plate and also form passage ways for the free cir-

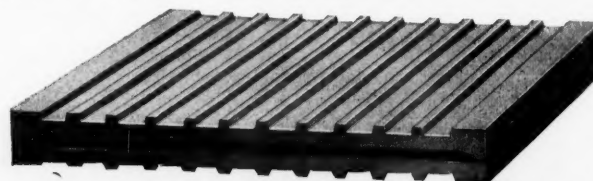


Fig. 2.



Fig. 3.

ulation of the electrolyte. Each plate is filled with lead-oxide paste and between the two plates is a sheet of lead which is only thick enough to conduct the current and leave a margin of safety. A horizontal section of a complete unit is shown in Fig. 3. The walls of

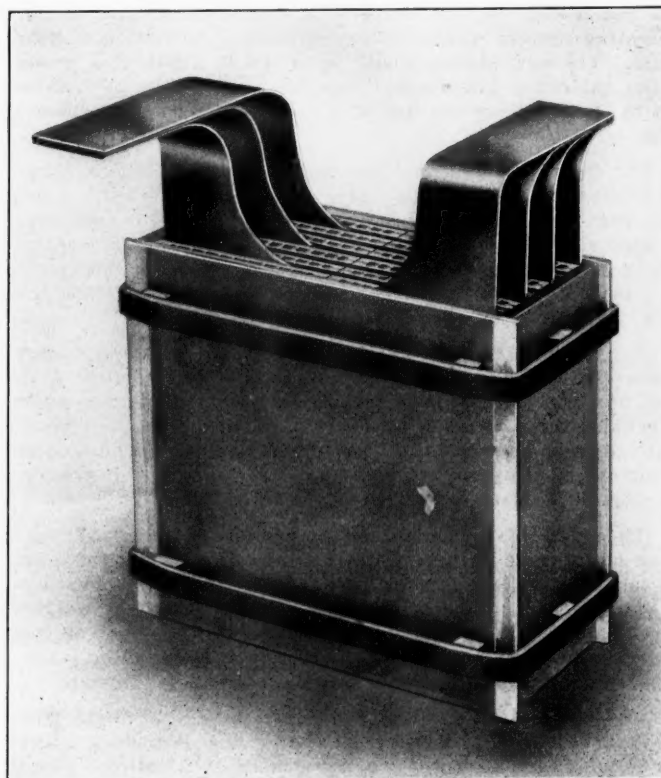


Fig. 4.



the plate are only about  $\frac{3}{4}$  in. thick and are so porous that the electrolyte passes through easily, although the pores are fine enough to retain the lead-oxide. Each unit, as described, is about  $3\frac{1}{2}$  in. square and  $\frac{1}{2}$  in. thick, having  $2\frac{1}{2}$  ampere hours capacity each. Large plates may be built up out of a number of the smaller plates, using a single sheet of lead as a conductor for all. In assembling the battery the separate units, or the larger built up plates, are connected in parallel, and hard lead bands are passed around them as shown in Fig. 4, tightly enough to hold the active material in close contact with the lead conductors. Rubber plugs are placed between the bands and the end plates, and the space at the ends of the plates is sealed with wax.

These batteries are made by the Standard Electric Accumulator Co., Jersey City, N. J. It is claimed that they show high efficiency and stand heavy, frequent overloads without noticeable damage.

#### Asbestos Protected Metal.

Annealed sheet steel, because of its lightness, ease of application and fire resisting qualities, has always been popular as a roofing material. Various means have been tried for protecting it from rust and the attack of acid fumes; many kinds of paint have been used, and the metal has been galvanized with zinc spelter or coated with tin, but none of these methods have been altogether satisfactory. Different light materials, such as prepared felt, saturated asbestos felt, etc., are also used as roofings. The desirable features of both these kinds of roofing are combined in asbestos protected metal. This is made as follows: Annealed sheet steel is immersed at a high temperature in a bath of cement compound, the expansion of the metal under heat allowing the preservative to penetrate it. The sheet is then passed through hot dripping rolls which take off the surplus compound and make the coating uniform. Asbestos felt is next applied to both sides, under heavy pressure, and the sheet is then cooled slowly. It is claimed that this protects the steel from all outside influences and that the bond between the asbestos and the cement coated steel is so strong that there is no danger of the materials becoming separated. The asbestos is not saturated, but has a clear white surface. It is also claimed that the material will resist fire, water, gas and sulphur fumes for an indefinite time, and that it has the strength, rigidity and lightness of sheet metal, as well as the convenience and ease of application of the best ready prepared roofing. It has been used for three or four years as roofing and siding on many kinds of railroad structures and other buildings, and has also been used for interior work. Because of the non-conductivity of the asbestos, the sheets will stand a great deal of heat without drawing or buckling. The accompanying illustration shows an installation in which the material is subjected to particularly severe treatment. This is the roof of a foundry building, wood planking being directly under the roofing. The cupola stack being short, live cinders and hot metal strike the roofing at its base before being in the air long enough to cool.

This roofing is made in flat or corrugated sheets, and also in the form of beaded siding, standing seam and other shapes. There are two qualities: Aspromet brand and Duckback brand. In the former, the texture of the asbestos is similar to the usual asbestos building felt and is absorbent. For outside work, this should be painted. In the other brand, the asbestos is waterproofed and has a glossy surface which does not require painting or other treatment. The Belen and Clovis coaling stations on the Belen cut-off of the Atchison, Topeka & Santa Fe (*Railroad Gazette*, March 13, 1908) are roofed and sheathed with Duckback brand, 24 gage corrugated steel being used for the roofing and 26 gage for the siding. The flooring of the conveyor at the Clovis plant is also of asbestos protected metal.

One use of asbestos protected metal is the Robertson car roof. This is an inside roof for box cars in which the joints between the sheets are made watertight. It is claimed that this roof is fireproof and rustproof, easy to apply, inexpensive and will minimize interior condensation.

These roofings are made by the Asbestos Protected Metal Co., Canton, Mass.

#### An English View of the Erie.

Robert Fleming, one of the best known English railroad experts, who is in this country representing the English security holders of the Chicago Great Western, has made the following statement in regard to the Erie Railroad:

"I don't know whether Erie is going into the hands of a receiver, but that would be the best thing that could happen to the security holders if it were followed by a sound reconstruction. Erie was, both bonds and stocks, mainly held in England thirty years ago, and my first experience in the reorganization of American railways was of the Erie in 1876. The committee were divided in opinion as to whether the then second mortgage bonds should be made a preferred stock. The majority unfortunately favored leaving it as a mortgage, but delaying its foreclosure powers. The result was that Erie never had credit and reconstruction after reconstruction followed.

"The reconstructions all had more or less the same fatal defect: no adequate provision for future capital requirements was made and the property was mortgaged almost up to its value. No big public service corporation in this go-ahead country is able to hold its place unless it has credit. Although the financial community is greatly indebted to Mr. Morgan for many things, his reorganizations have sometimes been dominated by too great an optimism.

"If this time he will have courage enough to bring forth from present troubles a new Erie that will not want periodical recon-



Foundry Roof Covered With Asbestos Protected Metal.

struction, he will have done a great thing for the security holders themselves and for the reputation abroad of American railroad securities.

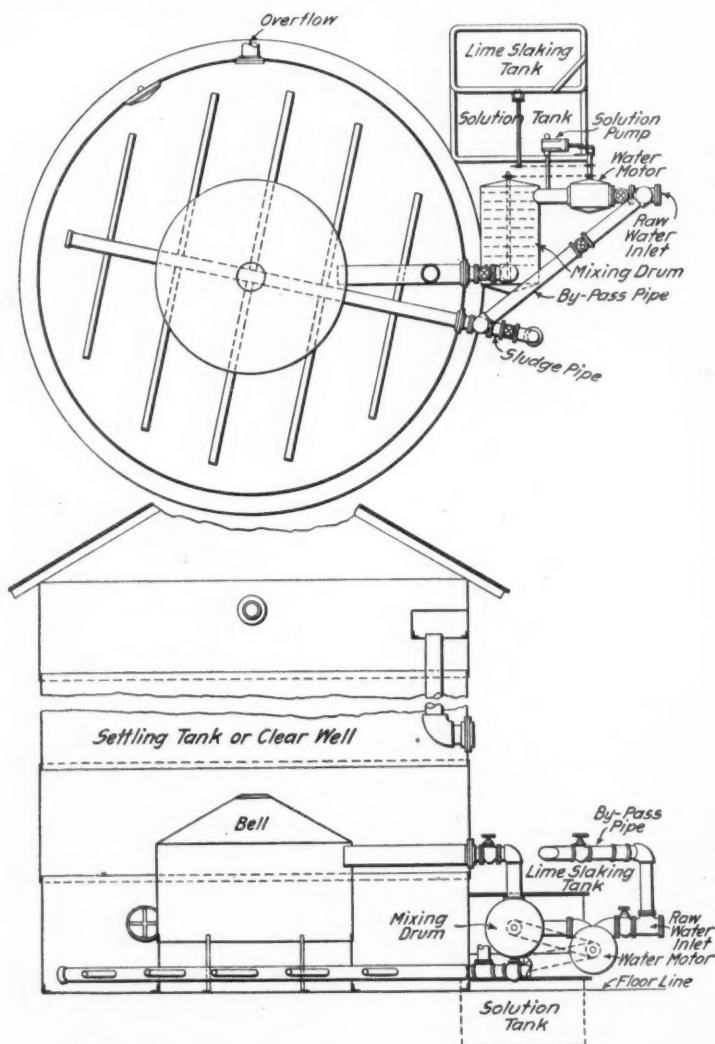
"All that is wanted to enable Erie to hold a front place in the railroad system of the country is that its mandatory charge be reduced to an absolutely safe limit. With the exceptional standing of J. P. Morgan & Co., I believe a reconstruction can be carried out without an actual foreclosure, because new securities can be given that would have a greater market value than the existing ones.

"It is not for me to propose a scheme, but, beginning with the general lien bonds, should they be offered a  $4\frac{1}{2}$  per cent. first cumulative preferred stock instead of their present bonds, and so on according to the rank of the junior securities, complete solvency would be established and Erie would be able to borrow what money it wants on a security that would sell at a high price. I say noth-

ing about assessment or reducing the stock. I think the investing public are beginning to realize that with able management it is better to have a good preference stock than a doubtful mortgage bond. Erie reorganized on a sound basis would be a distinct step towards improving the general situation."

#### The Holmen Water Softener.

The water softener illustrated herewith was built by the Southwest System of the Pennsylvania Lines West of Pittsburgh at the Indianapolis shops. It was designed by A. R. Holmen, chief draftsman of the motive power department. The capacity is 30,000 gals. an hour. It consists of a settling tank, mixing drum, solution tank with lime slaking tank above, an adjustable solution pump and a water motor, with the necessary piping. The motor drives stirring apparatus in the mixing drum and solution tank by chains and sprockets on its shaft, and drives the solution pump by an adjustable crank arm. Opening the raw water valve starts the motor and the apparatus which it drives. For each revolution of the motor the solution pump makes one stroke. The length of the stroke and



Plan and Section of Holmen Water Softening Plant.

the strength of the solution, which in this particular installation contains lime and soda ash, may be adjusted to inject the proper amount of chemicals into the raw water. The chemicals and water meet in the pipe between the motor and mixing drum, passing into the latter together. The mixture in the drum is agitated about a minute before passing into the bell in the settling tank. It passes out under the lower edge of the bell, and flows from the top of the settling tank to storage tanks through the overflow pipe.

It is claimed that the thorough mixing of the water and chemicals under pressure hastens the chemical action so that it is completed before the mixture leaves the bell; also that the precipitate is crowded together into more compact form, causing quick and complete clarification.

In the bottom of the tank there is a system of pipes connected to the waste pipe, for removing the sludge. The sludge pipe and raw water inlet are connected by a by-pass valve, so as to admit raw water directly to the settling tank for stirring the sludge or making repairs. No filter was installed, as it was thought the settling of the precipitate would be complete, but a pipe and the necessary floor space are provided so that sand filters may be put in if desired.

The softener has been in operation eight months with satisfactory results. The simplicity of the design, the few parts, and their accessibility, require little work for operation and maintenance.

#### Hanover Locomotive Works.

A consular report gives the following table of locomotives exported by the locomotive works at Hanover, Germany, to the year 1907.

|                |     |                   |    |                     |    |
|----------------|-----|-------------------|----|---------------------|----|
| Russia .....   | 251 | Bulgaria .....    | 21 | British Indies .... | 54 |
| Roumania ..... | 115 | Holland .....     | 18 | China .....         | 16 |
| Spain .....    | 79  | Greece .....      | 9  | Siam .....          | 16 |
| Denmark .....  | 55  | Norway .....      | 5  | Argentine Rep. .... | 14 |
| Turkey .....   | 54  | France .....      | 5  | Cochin-China ....   | 5  |
| Austria .....  | 48  | Sweden .....      | 4  | Chile .....         | 4  |
| Portugal ..... | 40  | Japan .....       | 93 | Brazil .....        | 3  |
| Italy .....    | 40  | Dutch Indies .... | 76 |                     |    |

#### The Pennsylvania in 1874 and in 1908.

The report of a committee of Pennsylvania Railroad stockholders which investigated the condition and prospects of the company in 1874 makes interesting reading in the light of the company's subsequent experiences. The year in which this committee performed its work offers some striking parallels with the present year, following as it did a year of severe panic and introducing an era of hard times the country over, and the fact that the committee, after probing into the fundamentals of the company's position with most surprising thoroughness and impartiality, reached some very cheerful conclusions, has its own lesson for railroad stockholders of to-day.

In retrospect, these conclusions are found to have been in many respects much too cheerful, even though the committee professed to have guarded itself sedulously against the natural human tendency toward exaggeration of future possibilities, and proved its professions by severely discounting the then book value of some of the company's assets. In the same way, the committee expressed the opinion that for many years no returns could be expected upon the stock of the Philadelphia & Erie, which has since become a highly important and profitable part of the system. Likewise, the committee said that the company's investments south of Baltimore were unfortunate and indefensible. So far as these investments represented ownership in what was afterward reorganized into the Southern Railway, the committee's judgment may have been well founded; yet it may be questioned whether the management of the Southern would have been just what it was if the Pennsylvania had retained an active interest in the property, while the Pennsylvania stockholders would regard it as unfortunate to-day if their road were without its entrance into Washington.

On the other hand, the committee declared that there was "no doubt of the ability of the company to earn not only its usual 10 per cent. dividend, but a surplus over and above expenses, liabilities and contingencies." The Pennsylvania was then paying 10 per cent. upon its stock, and had averaged 9.9 per cent. during all the twenty years since the main line was first opened to the public in 1853. The committee saw fit to warn the stockholders against the dangers of extension and expansion, a policy which it evidently thought the management had pursued to the point of recklessness. How much and how long circumstances allowed the management to take this warning to heart may be gathered from a comparison of mileage, capitalization and earnings of the Pennsylvania Railroad of 1873, with the same characteristics as they existed last year:

|  | 1907.         | 1873.        |
|--|---------------|--------------|
| Miles of road .....                          | 3,792         | 1,574        |
| Bonded debt .....                            | \$270,974,600 | \$43,145,700 |
| Debt per mile .....                          | 71,400        | 27,400       |
| Capital stock .....                          | 314,594,600   | 68,144,500   |
| Stock per mile .....                         | 83,000        | 43,300       |
| All capitalization, per miles .....          | 154,400       | 70,700       |
| Net capitalization of road .....             | 365,579,600*  | 61,579,200*  |
| Net capitalization, per mile .....           | 96,400        | 39,100       |
| Net capitalization per mile, all tr'ks ..... | 63,500†       | 30,700†      |
| Gross earnings .....                         | 164,812,800   | 39,983,100   |
| Gross, per mile .....                        | 43,400        | 25,400       |
| Net earnings .....                           | 45,205,500    | 13,745,300   |
| Net, per mile .....                          | 11,900        | 8,700        |

\*Less book value of securities owned, carried at cost.

†On mileage of first, second, third and fourth tracks, excluding sidings and yardage.

In 1873 the Pennsylvania earned about 12 per cent. on its capital stock and paid 10 per cent. Its earnings last year were practically the same, yet the dividends were only 7 per cent. Back of these two dry facts lies the history of American railroading for a generation. The increase in net earnings shown above is surprisingly small in comparison with the increase in capital invested as represented by stocks and bonds, and the gain would probably look smaller still in comparison with the actual increase in capital value of the plant employed. Taking this period as a whole and the experience of the Pennsylvania as typical within certain territorial limitations, the trend of financial adjustment between railroad stockholders on one side and labor and the users of railroads on the other has been in favor of the latter.

But the stockholders has undoubtedly been favored by an influence which does not appear in the figures. Railroads are a much



safer form of business undertaking now than they were then, and it would probably not be going too far to say that the increasing safety of railroad investment is directly related to capital's relinquishment of profits.—*Wall Street Journal*.

### INTERSTATE COMMERCE COMMISSION RULINGS.

#### Classification of Multigraphs Lowered.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of the Forest City Freight Bureau v. Atchison, Topeka & Santa Fe. It was held that inclusion by carriers operating under the Western Classification of multigraphs in cases in less than carloads, in double first class, is unreasonable. Defendants were ordered to classify such multigraphs as 1½ times first class.

#### Reparation on Shipment of Fruit Jars.

The Commission, opinion by Commissioner Cockrell, has announced decision in the case of the American Grocer Co. v. Pittsburg, Cincinnati, Chicago & St. Louis et al. The Commission granted reparation in this case against only the St. Louis, Iron Mountain & Southern for an excessive charge on one carload of glass fruit jars transported from Cairo, Ill., to Calico Rock, Ark. The rate charged was 37 cents per 100 lbs., but pending suit before the Commission it was reduced to 29 cents. The Commission also ordered that the 29-cent rate be maintained for one year from the date of the order.

#### No Authority Over Steamship Line to Cuba.

In Lykes Steamship Line v. Commercial Union and 13 railroads, opinion by Commissioner Cockrell, it was held that an ocean carrier established under the laws of Cuba and transporting traffic between Havana, Cuba, and Galveston, Tex., is not subject to the Rate Law. The rule laid down in the recent Cosmopolitan Shipping Company case was followed.

The Commission further declared that the word "adjacent" as used in the act to modify the words "foreign country," would seem to mean adjacent in the sense of the possibility of substantial continuity of rails.

#### Coal Rate Upheld.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of Laning-Harris Coal & Grain Co. v. St. Joseph & Grand Island. In January, 1907, the complainant shipped a carload of coal weighing 50,000 lbs. from Springfield, Ill., to Leona, Kan., a station on the line of the St. Joseph & Grand Island. Defendant assessed on this shipment a rate of 10.0013 cents per 100 lbs. Complainant insists that the rate should have been 9.0013 cents per 100 lbs. This was the only question presented. The Commission held that the charge collected was correct and dismissed the complaint.

#### No Authority to Require Special Passenger Rates.

In A. G. Field v. Southern Railway et al., opinion by Commissioner Harlan, it was held that the Commission has no authority to require carriers to establish special fares, based on less than the normal passenger-mile revenue, for the use of passengers on particular occasions or for special purposes. On that ground, and also on the ground that the legal right of carriers to issue party-rate tickets and confine their use to theatrical companies has been fully considered by the Commission, this complaint for an order requiring the defendants to re-establish such party rates is dismissed on motion of the Commission.

#### Reparation on Shipments of Iron Pyrites.

In Detroit Chemical Works v. Northern Central et al., opinion by Chairman Knapp, the rate of \$2.32 per ton on imported iron pyrites from Baltimore to Detroit was held to be now and during the time it was in effect, unreasonable and unjust; it should not have exceeded \$2.21 per ton. Reparation awarded.

In the similar case of Detroit Chemical Works v. Erie et al., opinion by Chairman Knapp, it was held that the rate of \$3.32 per ton on imported iron pyrites in carloads from New York to Detroit is now and was during the time it was in effect unreasonable and unjust; it should not have exceeded \$2.81 per ton. Reparation awarded.

#### Shippers' Instructions Govern Lower Rate by Another Route.

The Commission (opinion by Commissioner Lane) has announced decision in the case of the Larsen Canning Co. v. Chicago & North Western et al. It appeared that the complainant directed

that its shipments of two carloads of canned vegetables from Green Bay, Wis., to Washington, Ohio, move via a certain route over which there was no joint through rate, and the sum of the locals was applied. The goods might have been shipped by complainant between these points over a route having a joint rate less than the sum of the locals. The Commission held the initial carrier was bound to observe the instructions of the consignor in this case. It was also bound to collect the published rate applicable to the designated route and entails no liability under the law for so doing. No evidence was introduced tending to show that the rate charged and collected was unreasonable and unjust in itself. The complaint was dismissed.

#### Coal Rates from Wyoming to Nebraska Reduced.

In Nebraska State Railway Commission v. Union Pacific, opinion by Commissioner Clements, the complaint alleged that rates on coal from Rock Springs and Hanna, Wyo., to points in Nebraska, are unreasonable. The Commission held that the fact that there is competition for the purchase of this coal between Nebraska communities and communities in Wyoming and Utah affords no justification to the carrier for charging more than a reasonable rate for the transportation of such coal as the Nebraska people may succeed in buying. No justification exists for the maintenance of a blanket rate on coal to all points on defendant's lines in Nebraska. The Commission held that the rates of \$4.50 per ton applying on lump coal from Rock Springs, and \$3.50 per ton from Hanna to points in Nebraska on the line of the Union Pacific between the Nebraska-Wyoming boundary and Grand Island, Neb., including the latter point and points on the branch line from Kearney to Callaway, Neb., are unjust and unreasonable, and prescribed just and reasonable rates therefor.

#### Intra-State Rate Covering Part of Interstate Movement.

In Baer Bros. Mercantile Co. v. Missouri Pacific and Denver & Rio Grande, opinion by Commissioner Prouty, it was held that a railroad which lies entirely within the limits of a single state becomes subject to the act to regulate commerce by participating in a through movement of traffic from a point in another state to a point in the state within which it is located, although its own service is performed entirely within the latter state. To maintain a petition before the Commission for recovery of excessive freight charges it is not necessary that payment of the freight charges should have been made under protest. A rate of 45 cents on beer from Pueblo, Colo., to Leadville, which is part of a through transportation from St. Louis to Leadville, is excessive; such rate should not exceed 30 cents per 100 lbs. Reparation awarded.

The bringing of a suit in the United States Circuit Court for the recovery of excessive railroad charges is not a bar to a subsequent proceeding before the Commission where that suit was dismissed without prejudice, and for the reason that the Commission had never passed on the reasonableness of the rate involved.

#### No Authority Whatever Inside Oklahoma.

The Commission, opinion by Commissioner Clements, has announced its decision in the case of D. B. Hussey v. Chicago, Rock Island & Pacific. The complaint in this case asked for reparation on account of alleged unreasonable rates on shipments of cross-ties moving between April 25 and August 12, 1907, from Barnett, Ind. Ter., to McAlester. Subsequent to movement of these shipments and filing of the petition this territory was admitted as a state into the Union and the points of origin and destination are now in the state of Oklahoma. By the act of Congress admitting Oklahoma to statehood the intraterritorial jurisdiction of the Commission ceased to apply to territory now embraced in that state. The Commission held that it can make no lawful order in any case of which it has no jurisdiction and dismissed the complaint for want of jurisdiction.

The Commission in coming to this conclusion declared that if the subject-matter itself is not still within its jurisdiction, the fact that the complaint was filed and served prior to the transformation from territory to a state is wholly immaterial. The acquirement of jurisdiction of the parties by the filing and service of the complaint in no way helps the Commission to retain the case, if the law under which the jurisdiction over the subject-matter must be exercised has ceased to operate. If the Commission has jurisdiction now to award reparation in this case, it would seem that it would also have jurisdiction in all similar cases now or hereafter brought on causes of action which accrued in the territories from which the state was formed and which are not barred. Such a conclusion would create a situation in Oklahoma whereunder the Commission could be acting on one standard of rates as a basis for reparation on past shipments without power to alter the rates; whereas the state authority, which alone has power to alter them might be acting on an entirely different basis for that purpose—a condition incompatible with the principles and purposes of the

Rate Law which is intended to secure uniformity of rates and equality of treatment to all shippers.

Commissioner Harlin rendered an elaborate dissenting opinion.

#### Storage on Inland Shipments at Lake Ports.

The Commission, opinion by Commissioner Lane, has decided the case of the Commercial Club of Duluth v. Northern Pacific et al. The privilege of free storage was involved. The carriers offer free storage in transit at Duluth, Minn., or Superior, Wis., on both east-bound and westbound lake freight during the closed season of navigation. The practice is for inland shippers to bring their traffic to the warehouses at such ports before the close of navigation, where they are held in free storage by defendants until ordered forward by rail at the balance of the through rate from eastern points of origin. The Duluth merchants, having their business houses at the point where the storage is given, are compelled to pay storage and also dockage and switching charges. Complainant alleges that this business deprives Duluth of its advantage of location at the head of the lakes and operates to transfer such advantage to inland points. It appears that the privilege is open to all shippers alike and that the practice is not confined to defendants, but is forced by competition of other lines operating through other lake ports. The Commission held that the facts do not at this time justify condemnation of a practice in which so many carriers and shippers not parties to this action are interested. The fact that the privilege of free storage is more valuable to inland merchants than to merchants at lake ports does not necessarily make the privilege unlawful. The position of complainant is that the privilege takes away from the lake ports an advantage of their location; but the better position seems to be that the inland jobbing centers, by reason of their location at points where the competition of several lake ports operates, also have advantage of location, one result of which is seen in the effect of this privilege of free storage.

#### Obscure Rates Condemned.

In Hydraulic Press Brick Co. v. St. Louis & San Francisco et al., opinion by Commissioner Clements, it was held that defendants' rate of 48 cents per 100 lbs. for transportation of enameled brick from Cheltenham, Mo., to New Iberia, La., is unjust and unreasonable and should not exceed 30 cents per 100 lbs. for the future. Reparation awarded.

The practice of inserting obscure and general clauses in voluminous tariff publications, to the effect that where a combination of locals, either general or in specific instances, will make a lower aggregate through rate than the specific joint through rate therein stated, the former will be used, has been found by long experience to result in gross misapplication of the tariffs and in unjust discriminations. Under this practice the individual or concern whose business is large enough to warrant the employment of a traffic or rate expert will be able to secure combinations resulting in lower aggregate charges than can be secured by the smaller or occasional shipper who is unable to employ such an expert and who is required to pay the joint through rate appearing on the face of the tariff. It is self-evident that if such discriminations are to be broken up there can be but one lawful rate in effect at a given point on any commodity in the one direction between two points.

The carrier may, in its own interest if it so desires, carry for a longer distance over its own line than would be necessary if carried between the same points over the line of its competitor, in order to obtain part of the competitive business, on terms that will afford some profit. It does not necessarily follow, however, that a carrier in competing for traffic in this way thereby subjects itself to an order compelling it to do so.

#### No Permanent Lien on Jobbing Territory.

The Commission, opinion by Commissioner Prouty, has announced decision in the case of the Lincoln Commercial Club v. Chicago, Rock Island & Pacific et al. The complaint alleged that the defendants exact unreasonably higher rates on coal, paving brick, cement, lumber, glass and glassware, salt, rice, egg-case fillers and sugar, to Lincoln than to Omaha, from the same points of origin in Kansas and territory south, and west of the Mississippi river, for substantially the same distances. The Commission held that it is apparent that the cost of handling traffic from Kansas City to Omaha and Lincoln is practically the same and that difference in expense does not justify the maintenance of a higher rate to Lincoln than to Omaha. Justification for these higher rates must be found, therefore, if at all, in commercial and competitive conditions rather than in added cost of service. The questions presented were considered by the Commission as to each of the above articles separately, and the conclusions of the Commission were that the rate on coal may properly be 15 cents per ton higher to Lincoln and on paving brick and cement  $1\frac{1}{2}$  cents per 100 lbs. higher to Lincoln than to Omaha, and that with respect to lumber, glass and glassware, salt, rice, egg-case fillers, and sugar, rates from said

points of origin to Lincoln should not exceed those to Omaha. The Commission said:

"The defendants, with some earnestness, urged that the holding which we have made will require them to readjust their distributing rates from Lincoln and from Omaha, but we are unable to appreciate the force of this suggestion. Cities have no indefeasible lien upon any given jobbing territory. Changes in conditions are always likely to affect the boundaries of that territory. Conditions are not the same when Lincoln draws its supplies from points of production in the west or south that they were when these supplies came through Omaha from the east. It is no part of the business of a railroad to so adjust its tariffs as to artificially define the territory into which particular jobbing localities may sell."

#### Competitive Rate Adjustment Upheld.

In the case of the Railroad Commission of Kentucky v. Louisville & Nashville et al., opinion by Commissioner Clements, the complaint questioned reasonableness of rates between Owensboro and Henderson, Ky., and points in Trunk Line and Central Freight Association territories. It also alleged that such rates result in unjust discrimination against Owensboro and Henderson and give undue preference to Evansville, Ind.

The carriers most directly interested in the Evansville rates for the most part serve the territory north of the Ohio river, while those most directly interested in the rates to Owensboro and Henderson serve the territory south of the river. There is greater density of population and of traffic in the territory north of the Ohio river known as Central Freight Association territory in which Evansville is situated, than in territory south of the river, in which Owensboro and Henderson are situated. The general adjustment of rates throughout Central Freight Association territory has a forceful effect on the Evansville rates. The larger volume of traffic and greater number of carriers operating in that territory create a greater degree of competition and the rates generally have been adjusted with a view to meeting the conditions resulting therefrom.

It was held that it is not incumbent on a road to measure the rates to all points on its line from and to which it handles the bulk of the traffic, by lower rates fixed by competitors operating over a more direct route to some other point also on its line but to which it handles an unappreciable volume of traffic. So to hold would be totally to disregard the effect of competitive conditions which the Supreme Court has held in numerous cases to justify the application of lower rates to farther distant points over the same line in the same direction. The long and short haul clause as construed by the courts prohibits charging a higher rate to a less distant point only where the carrier responsible for both rates occupies a like relation to the more distant point to which the lower rate applies.

The record fails to show that the rates in question are, under present conditions, unreasonable in and of themselves, or that the circumstances and conditions under which the traffic is handled to and from Evansville are so substantially similar to those under which traffic is handled to and from Owensboro and Henderson as to make the charging of higher rates to and from the last mentioned points unjustly discriminatory as compared with the rates applying between Evansville and the same points in Trunk Line and Central Freight Association territories. The complaint was dismissed.

#### TRADE CATALOGUES.

**Roofing.**—A pamphlet issued by the Cortright Metal Roofing Co., Philadelphia, Pa., is entitled Rightly Roofed Buildings. The Cortright metal shingles are designed to give the advantages of the tin roof without the buckling and rattling of the ordinary tin roof. The shingles are locked together on the side in such a way as to allow for expansion and contraction, but without allowing water to get through; at the top they are molded in steps to prevent water from entering at this point. The pamphlet includes testimonials, and is illustrated with a number of photographs of buildings covered with this roofing.

**Vises and Ratchet Drills.**—Illustrated price list No. 5 of the Charles Parker Co., Meriden, Conn., shows a number of styles of vises for use in locomotive and car building plants and by metal workers and machinists generally. A new vise is described, made with a patented reinforced sliding jaw, in which a solid steel bar is inserted in the slide throughout its length, being thoroughly welded into the casting. The vises are made of a mixture of cast-iron and Bessemer steel. Ratchet drills and parts are also described, with dimensions, weights and prices.

**Water Softeners.**—Bulletin No. 120, of the Buda Foundry & Manufacturing Co., Chicago, describes the Buda intermittent and continuous systems of water softening. The method used in each is outlined and illustrations are shown. The adaptability of water treating plants and the economies of using soft water are pointed



out. The motor meter and chemical pump used are illustrated and described, and there are a number of illustrations of installations of both systems of both wood and steel construction.

**Asbestos Wood.**—Catalogue No. 107, of the H. W. Johns-Manville Co., New York, describes, with illustrations, the many uses of asbestos wood. These include roofing, sheathing and interior wood work. Its advantages in electrical work for taking the place of slate, marble, etc., are noted. This material is made in sizes from  $\frac{1}{4}$  in. thick to 2 in. thick, the standard size of sheet being 36 in. x 48 in. Price lists of different thickness and styles are given.

**Thermit.**—The Goldschmidt Thermit Co., New York, has begun the publication of a quarterly periodical, *Reactions*, the object of which is to make public the improvements made from time to time in the use of thermit. The first issue consists of a number of articles of this description, clearly illustrated with half-tones and drawings. There are also a few notes and short articles on other subjects of interest.

**Graphite.**—The April issue of *Graphite*, published by the Joseph Dixon Crucible Co., Jersey City, N. J., has a short note calling attention to Dixon's yellow crayons for engineers and surveyors. They are particularly useful for making marks on rails; it is claimed that the mark is not easily washed off by rain, but can be distinctly seen for several months.

**Derails.**—A circular of the Hayes Track Appliance Co., Geneva, N. Y., gives a condensed list of Hayes derails, illustrated with photographs of the different types.

#### MANUFACTURING AND BUSINESS.

The New York offices of the Crocker-Wheeler Co., Ampere, N. J., will be moved on April 24 to the Hudson Terminal buildings, 32 Cortlandt street.

The New York office of the Federal Signal Co., Albany, N. Y., has been moved from 42 Broadway to the Terminal building, Forty-first street and Park avenue.

The New York office of the Railroad Supply Co., Chicago, will be moved to the Hudson Terminal buildings on May 1. The address will be room 540, 32 Cortlandt street.

Porter Bros. & Welch, Railroad Contractors, Vancouver, Wash., have ordered, for work on the Northern Pacific, a number of 5,000 candle-power Milburn lights, manufactured by the Alexander Milburn Co., Baltimore, Md.

Robert C. Pruyn, President of the Consolidated Car Heating Co., New York, and Francis C. Green, General Manager, have declined re-election to their offices in the company. Their successors will be elected at the annual meeting in June.

The thirteenth annual convention of the International Association of Municipal Electricians will be held at Detroit, Mich., this summer. The Secretary, Frank P. Foster, Corning, N. Y., is asking members to suggest subjects to be presented and discussed at this meeting. Suggestions should be sent not later than April 20.

E. E. Keller, for over 20 years connected with the Westinghouse interests, and for 14 years Vice-President of the Westinghouse Machine Company, Pittsburgh, Pa., has completed his duties as Receiver and General Manager and resigned from the company. He will take a vacation and then devote most of his time to personal interests.

Nathaniel S. Bouton, President of the Maryland Car Wheel Co., died in Dunedin, Fla., April 3, aged 80 years. Mr. Bouton had lived, since 1852, in Chicago, where he established the Union Foundry Works. This concern was sold to the Pullman Company in 1886. At the time of his death, besides being the head of the Maryland Car Wheel Co., he had foundries at Aurora and Naperville, Ill., and Birmingham and Decatur, Ala.

John E. Greiner, Assistant Chief Engineer of the Baltimore & Ohio, has resigned, effective May 1, to become a Consulting Engineer. He will open offices in Baltimore, Md., New York and Chicago. Mr. Greiner has been building bridges on the Baltimore & Ohio for the last 20 years. He has designed, or had charge of the designing of, every bridge erected on this road since 1885. Among these structures are the Arthur Kill bridge, which, with a 520-ft. span, was at the time the largest bridge in the world; the Ohio river bridge at Benwood, W. Va., a 345 ft. span without false work; the Ohio river bridge at Parkersburg, W. Va., and the double-track bridge now being built at Havre-de-Grace, Md. Since 1899 he has also supervised the design of all stations and buildings on the road. He was born at Wilmington, Del., in 1859, and was educated at the Wilmington High School and Delaware College, where he took B.S. and C.E. degrees. From 1880 to 1883 he was a draftsman at the Edgemoor

Bridge Works; he then went to the Keystone Bridge Works, and in 1885 had charge of the Seventh Avenue suspension bridge at Pittsburgh, Pa. Later in that year he went to the Baltimore & Ohio, where he was, successively, draftsman, inspector of bridges, chief draftsman, Assistant Bridge Engineer, Engineer of Bridges and Building, and finally Assistant Chief Engineer. He is a member of the American Society of Civil Engineers, the American Railway Engineering and Maintenance of Way Association, and the Association of Railway Superintendents of Bridges and Buildings, and is serving on various committees of these societies.

#### Iron and Steel.

The Pittsburg & Lake Erie is said to be in the market for 14,000 tons of bridge material.

#### MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 26.)

#### American Society of Civil Engineers.

At a meeting of this society on April 15, a paper on "Recent Developments in Pneumatic Foundations for Buildings," by D. A. Usina was presented for discussion, illustrated with lantern slides. This paper was printed in "Proceedings" for March, 1908.

#### Freight Claim Association.

The seventeenth annual meeting of this association is to be held at Atlantic City, N. J., June 17, this date having been fixed in place of the date formerly announced (May 20). The President of this association is R. C. Richards, of the Chicago & North-Western, and the Secretary is W. P. Taylor (R., F. & P.), Richmond, Va.

#### Western Railway Club.

At the April meeting, to be held in the Auditorium Hotel at 8 o'clock p.m., Tuesday, the 21st inst., the paper of Prof. Dewsnap, of the University of Illinois, on "Freight Car Efficiency," which was read at the March meeting, will be discussed. Also the committee on Recommended Changes in the Rules of Interchange will report.

#### Association Railway Telegraph Superintendents.

At the meeting of this association to be held in Montreal, Que., June 24-27, the papers to be read include the following: "Dry Batteries on Telegraph Wires," by U. J. Fry, of Milwaukee; "Reduction of Telegraphing by Use of Printed Forms," by O. C. Greene, of St. Paul; "Commercial Reports," by G. C. Kinsman, of Decatur, Ill.; "Wiring of Station Buildings from the Contractor's Standpoint," by J. H. Jacoby; "Adverse Railroad Legislation," by E. A. Chenery, of St. Louis; "Telegraph Work on the Isthmus," by C. F. Annett, of New Haven, Conn.; "Qualifying Operators for Train Despatching," by C. S. Rhoads, of Indianapolis; "Selecting Operators for Railroad Use," by L. H. Korty, of Omaha; "Moving Trains by Visible Signals," by L. B. Foley, of New York; "Block Signals," by H. C. Hope, of St. Paul; "Use of Telephones in Connection with Train Movements," by W. W. Ryder, of Chicago; "The Interstate Commerce Commission," by Charles Selden, of Baltimore; "The Association," by W. F. Williams, of Portsmouth, Va.; "The Telephone," by F. F. Fowle, of Chicago.

#### International Master Boiler Makers' Association.

The second annual convention of this association is to be held in the Hotel Pontchartrain, Detroit, Mich., May 26-28. At this meeting there will be committee reports to be followed by topical discussions on the following subjects:

Best Method of Applying Flues. Best Method for Caring for Flues. E. J. Hennessy, Chairman.  
Boiler Explosions. J. T. Goodwin, Chairman.  
Best Method of Applying Flexible Staybolts. J. H. Smythe, Chairman.

Use of Oil in Boiler Shops; Its Use in Stationary and Locomotive Boilers.

Topical discussions will also take place on the following subjects:

"Standardizing of Shop Tools." T. C. Best.  
"Standardizing Boiler Blue Prints." W. H. Laughridge.  
"Modern Improvements and Physical Tests in Boiler Design and Materials." H. S. Jeffery.

Members of the convention on May 26 will visit the plants of the Chicago Pneumatic Tool Company and the Detroit Seamless Tube Company.

## ELECTIONS AND APPOINTMENTS.

## Executive, Financial and Legal Officers.

*Grand Trunk.*—M. M. Reynolds, heretofore Comptroller of the National lines of Mexico, has been appointed Fifth Vice-President of the Grand Trunk. He will have special supervision of the treasury and accounting departments of the Grand Trunk and general supervision of the finances of allied companies.

*Houston & Texas Central.*—S. F. Carter, Jesse H. Jones and E. B. Parker, all of Houston, have been elected directors, succeeding J. D. Bowne, T. W. House and A. P. Root.

C. C. Barry has been appointed Secretary, succeeding William H. Field, who remains Treasurer.

*Isthmian Canal Commission.*—Gen. Peter C. Hains has resigned as a member of the Commission.

*National Railroad of Mexico.*—W. L. Fritz, Assistant Auditor, has been appointed Auditor and his former position has been abolished.

*New York, New Haven & Hartford.*—Amory A. Lawrence, of Boston, Mass., has been elected a Director, succeeding Charles F. Choate, resigned.

*New York Public Service Commission, Second District.*—John B. Olmstead, of Buffalo, N. Y., President of the Municipal League, has been appointed Commissioner in the Second district to fill the vacancy caused by the resignation of Charles H. Keep to become President of the Knickerbocker Trust Co., New York City.

*Philadelphia & Reading.*—C. E. Henderson, Second Vice-President, has resigned on account of ill health.

## Operating Officers.

*Chicago & Eastern Illinois.*—E. H. DeGroot, Superintendent of the Indiana division, has been appointed Superintendent of the St. Louis division, with office at St. Louis, Mo., in place of R. D. Miller, deceased. P. S. Sampson succeeds Mr. De Groot, with office at Brazil, Ind.

*East Broad Top Railroad & Coal Co.*—C. H. Ketcham, whose resignation as Superintendent of the Morris & Essex division of the Delaware, Lackawanna & Western was recently announced, has been appointed General Manager of the East Broad Top and of the Rockhill Iron & Coal Co., with office at Orbisonia, Pa. Mr. Ketcham was born in 1855, and began railroad work as a telegraph operator in 1872 on the Louisville, Cincinnati & Lexington Railway, now part of the Louisville & Nashville. He served as yardmaster, Trainmaster, local freight agent and Assistant Superintendent. In 1890 he went to the Dunkirk, Allegheny Valley & Pittsburgh as Superintendent, where he served till 1896. In 1893 he was also made Superintendent of the Buffalo division of the West Shore, a position which he held till 1899. He then became terminal agent of the Delaware, Lackawanna & Western at New York, and a few months later was appointed Superintendent of the Morris & Essex division of that road, where he served until his present appointment.

*Missouri & North Arkansas.*—A. V. Brown, formerly Superintendent of the Chicago, Burlington & Quincy at Ottumwa, Iowa, has been appointed to the new office of Manager of the M. & N. A., with office at Eureka Springs, Ark.

*New York City Railway.*—W. L. Derr, General Superintendent, has resigned to go into contracting work, and his former office has been abolished.

*Tonopah & Goldfield.*—H. R. Hanlin, who has resigned as Trainmaster of the Baltimore & Ohio at Connellsville, Pa., has been appointed General Superintendent of the T. & G., with office at Tonopah, Nev.



C. H. Ketcham.

## Traffic Officers.

*Nevada Northern.*—H. B. Tooker has been appointed General Freight and Passenger Agent, in place of H. G. Toll, resigned; office at Ely, Nev.

*Tonopah & Goldfield.*—W. D. Foster has been appointed General Freight and Passenger Agent in place of J. F. Hedden, resigned.

## Engineering and Rolling Stock Officers.

*Baltimore & Ohio.*—John E. Greiner, Assistant Chief Engineer, has resigned, effective May 1. He will open offices in Baltimore, Md., New York and Chicago as a Consulting Engineer. The position of Assistant Chief Engineer will not be filled at present, but Mr. Greiner's duties will be performed by Walter S. Bouton, who will be promoted from Assistant Engineer of Bridges to Engineer of Bridges, and by M. A. Long, who will look after all work on buildings. Mr. Bouton and Mr. Long will both report directly to D. D. Carothers, Chief Engineer.

*Gulf, Colorado & Santa Fe.*—M. T. Pratt, Superintendent of the Texas & Gulf, has been appointed Division Engineer of the Gulf, Colorado & Santa Fe, with office at Beaumont, Tex.

*Texas & Gulf.*—See Gulf, Colorado & Santa Fe.

## LOCOMOTIVE BUILDING.

*Butler Brothers, Hibbing, Minn.,* have ordered two six-coupled switching locomotives from the Baldwin Locomotive Works instead of 30 as stated in the *Railroad Gazette* of March 27.

## CAR BUILDING.

*The Union R. R.* is in the market for extensive passenger car repairing.

*The Chicago, Milwaukee & St. Paul* has ordered a number of cabooses from the Ralston Steel Car Co.

*The Northern Pacific* is again figuring on refrigerator cars, but has changed the number to 500 instead of the 200 noted in the *Railroad Gazette* of March 6.

*The National Car Line Co., Chicago,* has ordered five 31-ft. steel tank car underframes, mounted on Bettendorf cast-steel trucks, of 80,000 lbs. capacity, from the Bettendorf Axle Co.

*The Milwaukee Refrigerator Transit Co.* has ordered 100 36-ft. refrigerator cars of 60,000 lbs. capacity from the Milwaukee Car Manufacturing Co., for May 20 delivery, to weigh 40,000 lbs.

*The Forest City Railway, Cleveland, Ohio,* it is said, is in the market for 100 pay-as-you-enter cars, and will remodel 50 ordinary cars into the pay-as-you-enter type. This item is not yet confirmed.

*The Pennsylvania's* order for 200 gondolas, noted in the *Railroad Gazette* of April 10, is an old order. The Middletown Car Works is just now starting work on these cars, the carrying out of the order having been held up for some time.

*The Panama Railroad* has rejected all bids on the 300 thirty-ton box cars and the 100 forty-ton Rodger convertible ballast cars, for which specifications were given in the *Railroad Gazette* of February 21. New bids have not yet been asked, but it is expected that they will be.

*The Ardmore Traction Co., Ardmore, Okla.,* has ordered four single-truck closed electric cars from the St. Louis Car Co. instead of the McGuire-Cummings Manufacturing Co., as stated in the *Railroad Gazette* of March 20. These cars will be 20 ft.  $\frac{3}{4}$  in. long, 7 ft. 4 in. wide and 8 ft.  $1\frac{1}{2}$  in. high, inside measurements. The special equipment includes:

|                        |  |
|------------------------|--|
| Brakes .....           | St. Louis Car Co. vertical wheel hand brakes |
| Couplers .....         | St. Louis Car Co. radial                     |
| Curtain fixtures ..... | Burrows                                      |
| Curtain material ..... | Pantasote                                    |
| Seats .....            | St. Louis Car Co.                            |
| Trucks .....           | St. Louis Car Co.                            |

## RAILROAD STRUCTURES.

*BETHLEHEM, PA.*—Contract has been given to Fine & Harris, of Philadelphia, at \$27,000 for the steel superstructure of the Northampton Heights bridge. S. W. Childs, of Philadelphia, was given a contract for the sub-structure at \$15,000. The proposed structure will be 378 ft. long and is to be built jointly by the Easton & South Bethlehem Transit Co., the Bethlehem Steel Co. and the Borough of Northampton Heights.

*BOSTON, MASS.*—The loss of the Boston Elevated in the recent Chelsea fire included a car barn, one car and seven snow-plows.

*BROWNSVILLE, TEXAS.*—President B. F. Yokum, speaking in behalf of the St. Louis, Brownsville & Mexico, confirms the report that this company has applied for permission to build a bridge over the Rio Grande river from Brownsville, Tex., to Matamoros, Mex.